California Instruments
A Norlin Technology Company

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California Instruments
A Norlin Technology Company

August 1976
Revision B

INSTRUCTION MANUAL

MODEL 1360
1361
DYNAMIC

LINE CORRECTOR

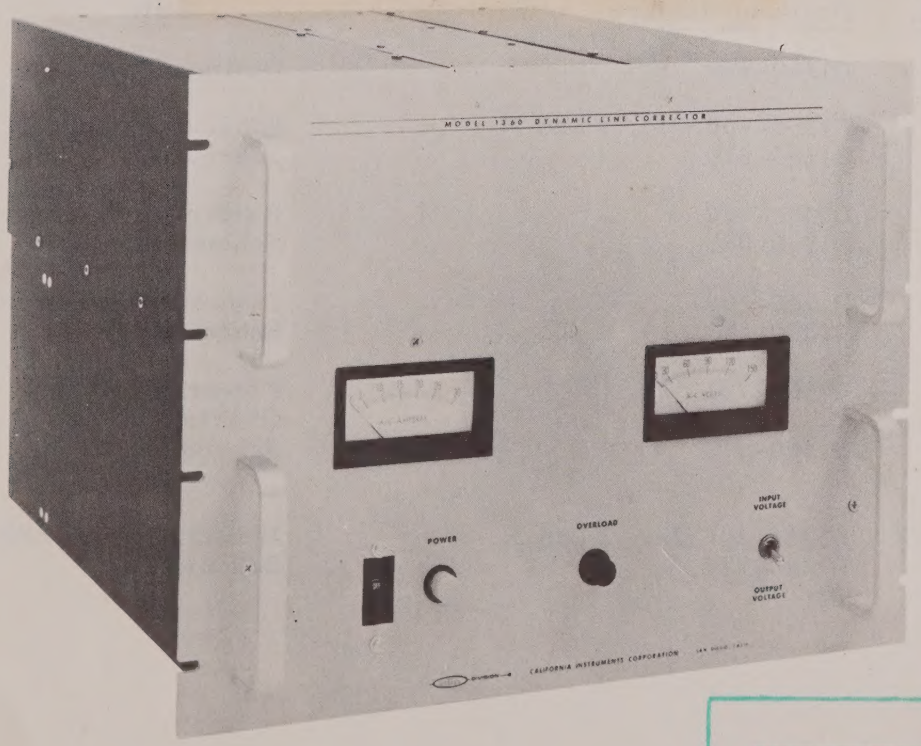

FIGURE 1.

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LIST OF ILLUSTRATIONS

Figure	Title	Page
1	MODEL 1360 (GENERAL)	Frontispiece
2	BLOCK DIAGRAM (GENERAL)	9
3	BLOCK DIAGRAM (REFERENCE GENERATOR)	11
4	TEST CIRCUIT (GENERAL)	21
5	TEST CIRCUIT (D. C. COMPONENT IN OUTPUT)	23
6	TEST CIRCUIT (HARMONIC DISTORTION)	27
7	TEST CIRCUIT (STEP LINE and LOAD RESPONSE)	29
8	TEST CIRCUIT (RESPONSE TIME)	31
9	ADJUSTMENTS AND TEST POINTS	34

LIST OF DRAWINGS

Assembly Ref. Des.	Drawing Number	Title
	C1360-900	Outline Drawing
	E1360-400 (Sht. 2 and 3)	Final Assembly
	E1360-070	Schematic
A1	D1360-700	Reference Board Assembly
	E1360-071	Schematic
A2	D1360-701	Preamplifier Board Assembly
	D1360-072	Schematic
A3	D1360-702	Power Supply and Overload Board
	D1360-073	Schematic
A4, A5 A6, and A7	D1360-401 (Sht. 2 and 3)	Heat Sink Assembly
	D1360-074	Schematic

MODEL 1361 MANUAL ADDENDUM

Model 1361 Dynamic Line Corrector is the same as Model 1360 Dynamic Line Corrector except for minor modifications to operate from 208/220/230 volt input lines. The front panel voltmeter is changed from a 0 to 150 volt full scale to 0 to 300 volt full scale and the front panel circuit breaker is changed from a 50 ampere breaker to a 25 ampere breaker.

A schematic diagram for the Model 1361 Dynamic Line Corrector is shown in drawing 1360-070 and a modification parts list is shown in drawing 1361-400.

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PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	1360-400-1	UNIT ASSY.	16067		1
					2
ADD:					3
					4
CB1	AM12-25-250-5-60	CIRCUIT BREAKER, 250V,			5
		60Hz,CURVE 5	74193	2-70014	6
	1360-201-7*	FRONT PANEL W/O Screening	16067	1-30169	7
	1060-214-9	TAG, VOLTAGE	16067	1-10165	8
	*SCREEN PANEL PER SSM 1361-100				9
M2	50-167031RXRX	METER, 0-300VAC	03508	2-41101	10
					11
T1	1995-010-1	TRANSFORMER	16067	7-10189	12
T2	1995-011-1	TRANSFORMER	16067	7-10190	13
					14
XDS1	TAG-6026-TA160AC	LAMP HOLDER	03797	2-50084	15
					16
					17
DELETE:					18
					19
CB1	AM12-50-250-5-60	CIRCUIT BREAKER	74193	2-40319	20
	1360-201-7	FRONT PANEL	16067	1-30169	21
	1060-214-7	TAG, VOLTAGE	16067	1-30151	22
					23
M2	50-167031PZPZ1	METER, 0-150VAC	03508	2-41069	24
					25
T1	1360-010-1	TRANSFORMER	16067	7-10123	26
T2	1360-011-1	TRANSFORMER	16067	7-10124	27
					28
XDS1	TAG-6022-TA160AC	LAMP HOLDER	03797	2-41113	29
					30
					31
					32
					33
					34
					35
					36

MODEL 1361 | CALICO P/N 1361-400 | ASSY R.D.

TITLE DYNAMIC LINE CORRECTOR | SHT 2 OF 2

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TABLE OF CONTENTS

		PAGE
GENERAL DESCRIPTION		
1.1	INTRODUCTION	1
1.2	DESCRIPTION	1
1.3	EQUIPMENT SUPPLIED	1
1.4	ACCESSORY EQUIPMENT	1
INSTALLATION AND OPERATION		
2.1	UNPACKING	3
2.2	POWER REQUIREMENTS	3
2.3	CIRCUIT BREAKER PROTECTION	3
2.4	ACCEPTANCE TEST PROCEDURE	3
2.5	MECHANICAL INSTALLATION	5
2.6	INPUT POWER WIRING	5
2.7	OUTPUT POWER WIRING	5
2.8	FRONT PANEL METERS	6
2.9	INSTRUMENTATION LOADS	6
2.10	FRONT PANEL CONTROLS	7
APPLICATION		
3.1	GENERAL	8
THEORY OF OPERATION		
4.1	GENERAL	10
4.2	DETAILED CIRCUIT DESCRIPTION	10
CALIBRATION PROCEDURE		
5.1	GENERAL	20
5.2	TEST EQUIPMENT REQUIRED	20
5.3	REFERENCE BOARD ADJUSTMENTS	20
5.4	POWER SUPPLY BOARD ADJUSTMENT	24
5.5	OUTPUT VOLTAGE STABILITY at CONSTANT LINE, LOAD and TEMPERATURE	25
5.6	OUTPUT VOLTAGE COEFFICIENT	25
5.7	LINE REGULATION	25
5.8	LOAD REGULATION	25

PAGE

5.9 HARMONIC DISTORTION 26
5.10 STEP LINE CHANGE 26
5.11 STEP LOAD CHANGE 28
5.12 CYCLE TO CYCLE PEAK AMPLITUDE INSTABILITY 28
5.13 IMPULSE SETTLING TIME 30

MAINTENANCE AND TROUBLE SHOOTING
6.1 GENERAL 35
6.2 TROUBLESHOOTING 35

CIRCUIT DIAGRAMS
7.1 GENERAL 36
7.2 REFERENCE DESIGNATIONS 36

REPLACEABLE PARTS
8.1 GENERAL 49
8.2 ORDERING INFORMATION 49

PARTS LIST

APPENDIX A
CODE LIST OF MANUFACTURERS

SPECIFICATIONS

MODEL 1360 DYNAMIC LINE CORRECTOR

All specifications are tested in accordance with standard California Instruments test procedures.

INPUT CHARACTERISTICS

VOLTAGE: (selected by tap switch)	95 - 115 volts rms 105 - 125 volts rms 115 - 135 volts rms.
FREQUENCY:	57 to 63 Hz.
POWER:	4800 watts maximum.
HARMONIC DISTORTION:	10 per cent maximum.
ISOLATION:	100 dB common mode isolation. Low side of output normally strapped to chassis but may be floated to 300 volts rms.

OUTPUT CHARACTERISTICS

VOLTAGE:	115 volts rms ± 0.15 per cent.
VOLTAGE SETABILITY:	± 0.01 per cent.
VOLTAGE INSTABILITY:	± 0.05 per cent for 24 hours under constant line, load and ambient temperature conditions.
POWER:	3000 VA from unity to ± .7 power factor; 15,000 VA maximum peak instantaneous power.
HARMONIC DISTORTION:	0.2 per cent maximum.
LINE REGULATION:	0.025 per cent for a 10 volt incoming line change.
LOAD REGULATION: (when sensed at four-wire heavy duty output connector)	0.025 per cent for a zero to full resistive load change. 0.05 per cent for a zero to full load change at ± 0.7 power factor.
AMPLITUDE TEMPERATURE COEFFICIENT:	0.005 per cent per degree C maximum.
CYCLE-TO-CYCLE PEAK AMPLITUDE STABILITY:	± 0.01 per cent for input line cycle-to-cycle phase stability of ± .18 degrees (typical power line).

LOAD CAPACITANCE:	300 μfd maximum at 0.1 power factor or greater.

TRANSIENT CHARACTERISTICS

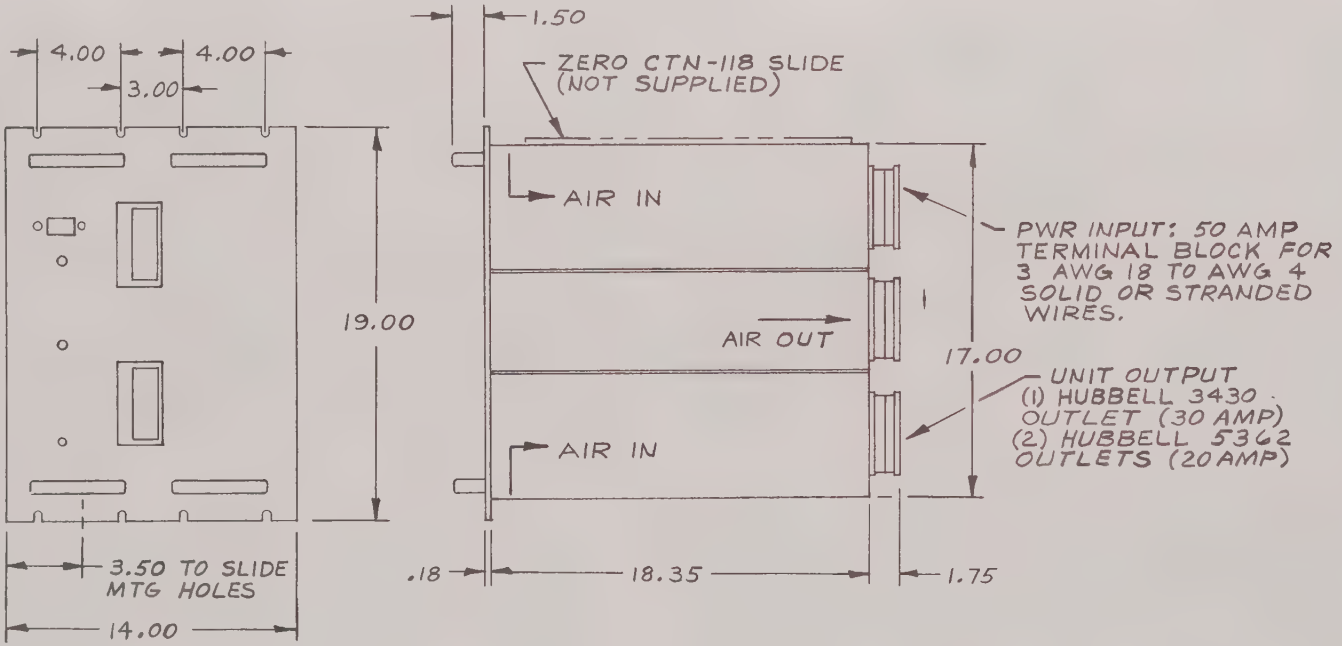
LINE: (with 10 per cent step change)	Output transient will not exceed 0.5 per cent peak amplitude and will fall to 0.05 per cent in less than 0.5 seconds.
LOAD: (zero to full load change)	Output transient will not exceed 0.5 per cent peak amplitude and will fall to 0.05 per cent in less than 0.5 seconds.
IMPULSE SETTLING TIME: (due to 3 ampere, 1 milli-second load pulse)	50 micro seconds or less to .5 per cent of output voltage.
OVERLOAD RECOVERY TIME:	Automatically recovers in less than one cycle when overload is removed.
OVERLOAD INDICATION:	Front panel lamp illuminates when load exceeds 3 KVA. Raw AC power is applied to load during overload.
OVERLOAD PROTECTION:	Excessive overload condition actuates front panel circuit breaker.

GENERAL

AC VOLTMETER:	Input and output voltages are monitored with a switchable 0 - 150 volt AC voltmeter. Meter accuracy is ± 3 per cent of full scale.
AC AMMETER:	Output current is continuously monitored with a 0 - 30 ampere AC ammeter. Meter accuracy is ± 5 per cent of full scale for a sinusoidal current flow.
AMBIENT TEMPERATURE:	0 to 55 degrees C.
STORAGE TEMPERATURE:	-20 degrees C to +85 degrees C.
COOLING:	A blower provides internal forced air circulation; air does not pass through front panel.
DIMENSIONS:	19" W x 14" H x 20.25" D for standard rack mounting.

NET WEIGHT:	190 pounds. (86.18 Kg)
SHIPPING WEIGHT:	200 pounds. (90.72 Kg)
FRONT PANEL FINISH:	Grey 26440 per Federal Standard 595.

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD



NOTES: (UNLESS OTHERWISE SPECIFIED)

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

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TITLE: OUTLINE DRAWING 3KVA LINE CORRECTOR

MODEL 1360

RELEASE			
CHECKER	[illegible]	5/2/	PURCHASING
DESIGN	[illegible]	5/0/9	PROJ ENGR
DRFTSMN	[illegible]	5/0/9	CHF ENGR

CALICO
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SAN DIEGO, CALIFORNIA

CONTRACT NO.
CODE IDENT 16067

DWG NO. C1360-900 REV /

SCALE 1/4 SHEET 1 OF 1

CALICO F-102

C1360-900 /

GENERAL DESCRIPTION

1.1 INTRODUCTION

This instruction manual contains information on the application, installation, operation, calibration and maintenance of the California Instruments Model 1360 Dynamic Line Corrector. A detailed theory of operation is provided as an aid to maintenance personnel. Complete parts listing, schematics and component drawings are also supplied.

1.2 DESCRIPTION

The California Instruments Model 1360 Dynamic Line Corrector is illustrated in Figure 1. This unit is a highly reliable solid state power supply designed to produce precisely regulated, transient-free AC power. The California Instruments Model 1360 Dynamic Line Corrector accepts an AC input voltage with up to 10 per cent harmonic distortion and delivers a sine wave output voltage with less than 0.2 per cent distortion.

The dynamic line corrector will supply 115 volts rms at 3000 VA output with a load power factor between 1.0 and 0.7 either lag or lead.

The Model 1360 Dynamic Line Corrector has been completely designed with silicon semiconductors utilizing conservative derating techniques to provide years of dependable service.

1.3 EQUIPMENT SUPPLIED

The California Instruments Model 1360 Dynamic Line Corrector is normally shipped with an instruction manual. This unit is equipped with a flat front panel for mounting in a standard 19 inch rack.

1.4 ACCESSORY EQUIPMENT

The following equipment is available for use with the California Instruments Model 1360 Dynamic Line Corrector:

1.4.1 Model 1360-703 Extender Card. This card allows the printed circuit boards to be extended above the unit for service work.

1.4.2 Model 1360-800 Extender Cable. This cable allows one of the power transistor heatsinks to be removed from the main chassis during service work. If the unit is to be operated with both heatsinks removed from the main chassis, two cables will be required.

WARNING

Voltages up to 125 VAC are available in certain sections of this line corrector. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with the primary power circuits and the 115 volt AC output circuit of the line corrector.

INSTALLATION AND OPERATION

2.1 UNPACKING

Each California Instruments Model 1360 Dynamic Line Corrector is shipped in a cardboard container with protective inner packing. Do not destroy the packing container until the unit has been inspected for possible damage in shipment.

2.2 POWER REQUIREMENTS

The California Instruments Model 1360 Dynamic Line Corrector operates from the 60 Hz AC power line over the voltage range from 95 volts rms to 135 volts rms in three sub-ranges: 95 to 115 volts, 105 to 125 volts, and 115 to 135 volts. These sub-ranges are selected by a three-position tap switch located at the rear of the line corrector. The unit is normally shipped with this tap switch set for a line voltage range from 105 volts to 125 volts.

Voltages above these limits in each specific range may damage the line corrector and/or cause excessive distortion to appear on the output of the line corrector. Voltages below these limits will cause excessive distortion to appear on the output of the line corrector.

The line corrector draws approximately 4200 to 4800 watts from the AC line when it is operating under full load.

2.3 CIRCUIT BREAKER PROTECTION

The Model 1360 Dynamic Line Corrector is protected by a single 50 ampere circuit breaker located on the front panel. Small overloads will not cause the circuit breaker to trip but will cause a solid state overload circuit to be actuated. The line corrector will supply unregulated power during this time. Large overloads (six hundred watts or greater) will trip the circuit breaker and the output of the line corrector will go to zero.

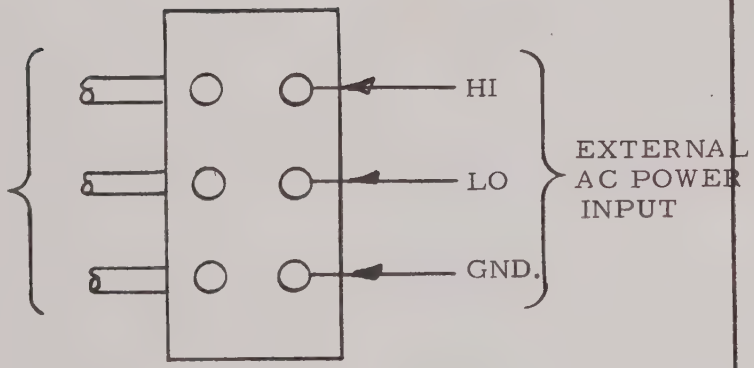
2.4 ACCEPTANCE TEST PROCEDURE

Inspect the unit for any possible shipping damage immediately upon receipt. If any damage is evident, notify the carrier. Do not return an instrument to the factory without prior approval. If the unit appears to be in good condition, perform the following:

2.4.1 Connect 115 VAC, 60 Hz to the terminal board at the rear of the line corrector. Use number 8 wire for each conductor. Connect a 5 KW wattmeter in series with the AC line. The wattmeter should indicate between 100 and 250 watts at the 115 volt line with no load applied to the output of the line corrector.

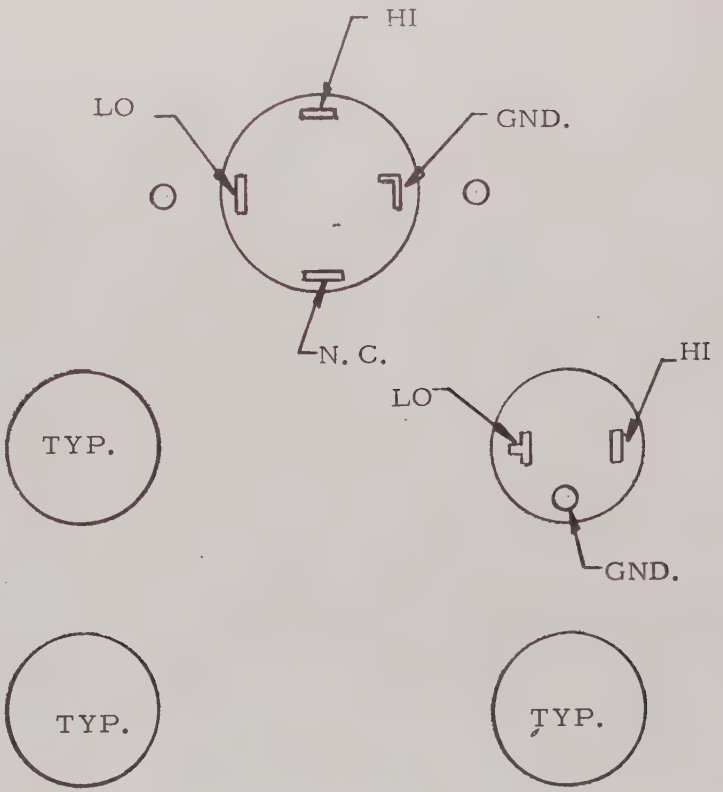
2.4.2 Monitor the output voltage of the line corrector at the single four wire AC line connector at the rear of the unit. This voltage should be 115 volts rms ± 0.15 per cent.

INPUT TERMINAL BLOCK



INPUT POWER WIRING DIAGRAM

OUTPUT RECEPTACLES



OUTPUT POWER WIRING DIAGRAM

2.4.3 Connect three 1000 watt resistive heating coils (13.2 ohms each) to one or both of the dual AC line connectors at the rear of the unit. The wattmeter should indicate between 4200 and 4800 watts at full load. The output voltage should vary less than .025 per cent from no load to full load. If any problem appears to be evident, check that the input voltage to the line corrector is still 115 volts. If the input voltage has dropped to 105 volts under full load, then it is permissible for the output of the line corrector to vary 0.05 per cent as this now represents a test of both line and load simultaneously.

2.4.4 Place a 600 watt resistive load (22 ohms) in parallel with the 3000 watt load. The overload light should indicate and the line corrector should go out of regulation. When the 600 watt overload is removed, the line corrector should immediately return to normal operation. Potentiometer A3R12 on the power supply board may require a slight adjustment.

2.5 MECHANICAL INSTALLATION

The Model 1360 Dynamic Line Corrector is designed for rack mounting. The cooling fans at the rear of the line corrector must be free of any obstructions which would interfere with the flow of air. A two inch clearance should be maintained between the rear of the fan and the rear door of the mounting cabinet. Also, the air intake holes on the sides and rear of the line corrector must not be obstructed. The Model 1360 Dynamic Line Corrector has mounting provisions for a set of three inch rack slides (zero manufacturer's part number CTN 118) which may be attached to the unit, if desired. These rack slides are not normally shipped with the line corrector.

2.6 INPUT POWER WIRING

The Model 1360 Dynamic Line Corrector will operate at input voltages of 95 to 135 volts in three ranges as described in Section 2.2 of this manual. The line corrector should be used with AC power lines with a capacity of 50 amperes or greater. The following figure shows how to connect the input power to the line corrector. Number 8 or larger wire should be used for this purpose.

2.7 OUTPUT POWER WIRING

The regulated output appears at the four wire connector and at both dual two-blade AC power connectors located at the rear of the line corrector. The four wire connector is capable of handling the full output of the line corrector and should be used if the load is not to be split between several pieces of equipment. The negative feedback is sensed directly across the terminals of this connector and hence this connector presents the lowest output impedance of the line corrector (less than .001 ohm).

Both of the dual two-blade AC power connectors are connected in parallel with the four wire connector and are used for convenience when several loads must be connected to the output of the line corrector. The output impedance of the line corrector is somewhat higher (approximately 0.005 ohm) when these outlets are used due to the short length of wire between these outlets and the master four wire outlet.

The unit is shipped for operation with the chassis connected with a grounding strap to the low side of the output. If isolated operation is required, remove this grounding strap to bring the output above chassis ground.

2.8 FRONT PANEL METERS

The Model 1360 Dynamic Line Corrector is equipped with an AC voltmeter which can be switched from the front panel of the unit to read either the input voltage or the output voltage of the line corrector. This meter has an accuracy of ± 3 per cent of full scale.

A 0-30 ampere AC meter is used to continuously monitor the output current from the line corrector. Full power output corresponds to load current of 26.1 amperes provided that the load current is sinusoidal. The accuracy of this ammeter is ± 5 per cent of full scale for sinusoidal current flow.

2.9 INSTRUMENTATION LOADS

Most electronic equipment, which might be used as a load on the output of the line corrector, exhibits a high ratio of peak current to rms current. This ratio of peak current to rms current is called the crest factor. This crest factor varies from 1.414 for a pure resistive load to approximately 3.5 for a rectifier type load with a large capacitive input filter and a low source impedance. The Model 1360 Dynamic Line Corrector has been designed for use with loads whose crest factor varies from 1.0 to 3.5 and therefore will provide excellent performance with 3000 VA of instrumentation load.

The typical instrumentation load with rectifier and capacitive input filter exhibits a leading power factor of approximately 0.9. The Model 1360 Dynamic Line Corrector will supply full VA output with power factors from unity to ± 0.7.

The line corrector has been designed to optimize the gain bandwidth product of the correction amplifier, thereby, providing the maximum rejection to high frequency noise spikes as can be achieved with power active filter techniques. As a result, the maximum pure capacitive load is limited to a few micro farads. For practical cases, where a small series resistance is permissable (0.1 power factor or greater), the unit will drive over 300 microfarads of load capacitance.

2.10 FRONT PANEL CONTROLS

The circuit breaker, located on the front panel of the line corrector, is used to switch the unit "on". At this time the indicator located above this circuit breaker should glow.

The OVERLOAD indicator, located on the front panel, is used to indicate that the solid state overload protection circuit has been activated. Whenever this lamp is glowing, the line corrector is delivering unregulated power to the load. The OVERLOAD indicator is actuated for approximately 2 seconds when the power is first applied to the line corrector.

The OVERLOAD indicator operation is almost totally independent of the load crest factor, thereby providing a reliable indication of overload for all instrumentation loads.

APPLICATION

3.1 GENERAL

The California Instruments Model 1360 Dynamic Line Corrector was designed to produce precisely regulated, transient-free AC power for applications where line transients may cause equipment failure, equipment inaccuracy, or a loss of valuable data. For example:

a) Analog and digital data systems.

b) Digital computer applications.

c) Line power for laboratory standards.

d) Regulated power for RFI chambers, engineering laboratories, etc.

e) Applications where motor starting transients might interfere with sensitive electronic equipment.

f) Regulated power for x-ray applications.

g) Applications where SER transients might interfere with sensitive electronic equipment.

h) Process control instrumentation.

In addition the following instruments are usually susceptible to line transients which are removed by the Model 1360 Dynamic Line Corrector.

a) Spectrum analyzers.

b) Mini computers.

c) Gas chromatographs.

d) Nuclear scalers.

e) Infrared scanners.

f) Scanning electron microscopes.

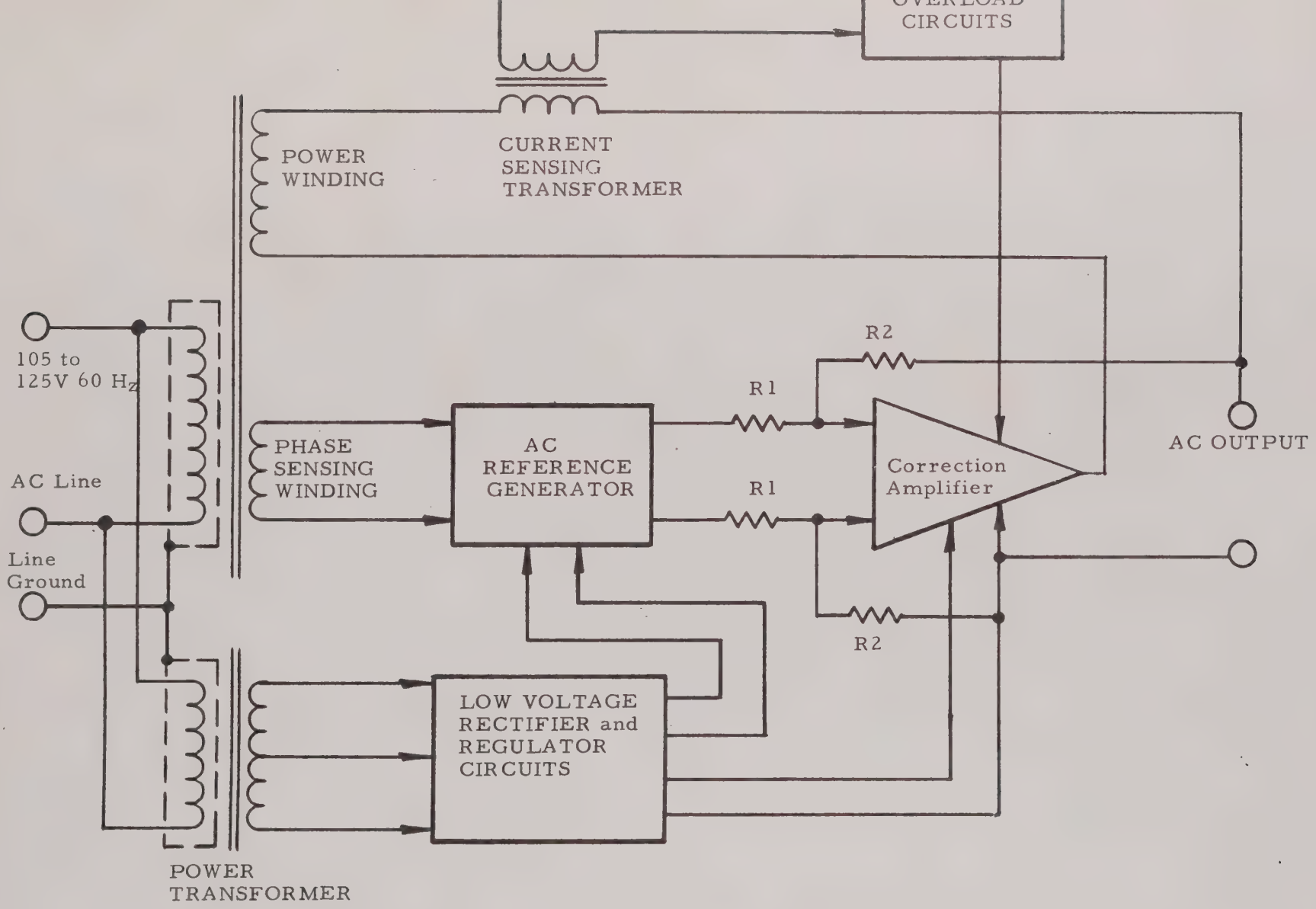


FIGURE 2. Block Diagram for Model 1360 Dynamic Line Corrector.

THEORY OF OPERATION

4.1 GENERAL

The California Instruments Model 1360 Dynamic Line Corrector is a precision solid state power supply designed to produce precisely regulated, transient-free AC power while operating from the standard AC power line. A block diagram is given in Figure 2 which illustrates the basic theory of operation. The raw AC input power is coupled to the system through a box shielded power transformer. This transformer provides 100 dB of common-mode isolation between the raw input power and the regulated output power. The low coupling capacitance also reduces the level of RF noise and spikes coupled into the line corrector via the raw AC line.

The majority of the output power is delivered from the power winding contained on the power transformer. The power winding is connected in series with the output of the correction amplifier such that the algebraic sum of these two voltages is a pure, distortion-free sine wave.

The correction amplifier and power winding are enclosed by a differential operational feedback loop driven by an AC reference generator. This AC reference generator supplies a pure sine wave output which is phase locked to the 60 Hz AC line by means of a phase sensing winding on the power transformer. The distortion contained in this sine wave is very small (typically less than 0.1 per cent) and amplitude regulation is excellent (typically about .01 per cent per 24 hours).

The overload section consists of a current sensing transformer and the associated overload circuitry. The output of this overload circuitry is used to drive clamping circuits in the correction amplifier. These clamp circuits protect the correction amplifier from excessive load currents and allow the unit to supply unregulated power while in the overload mode.

4.2 DETAILED CIRCUIT DESCRIPTION

A schematic diagram for the Model 1360 Dynamic Line Corrector is given in drawing numbers 1360-070 through 1360-074. These drawings also give typical voltage levels for all sections of the line corrector.

4.2.1 REFERENCE GENERATOR

The reference generator is contained on printed circuit board number 1360-700. The assembly number for this board is A1.

The reference generator is electrically divided into two basic sections: the amplitude control servo system and the phase control servo system. Figure 3 shows a block diagram of the reference generator.

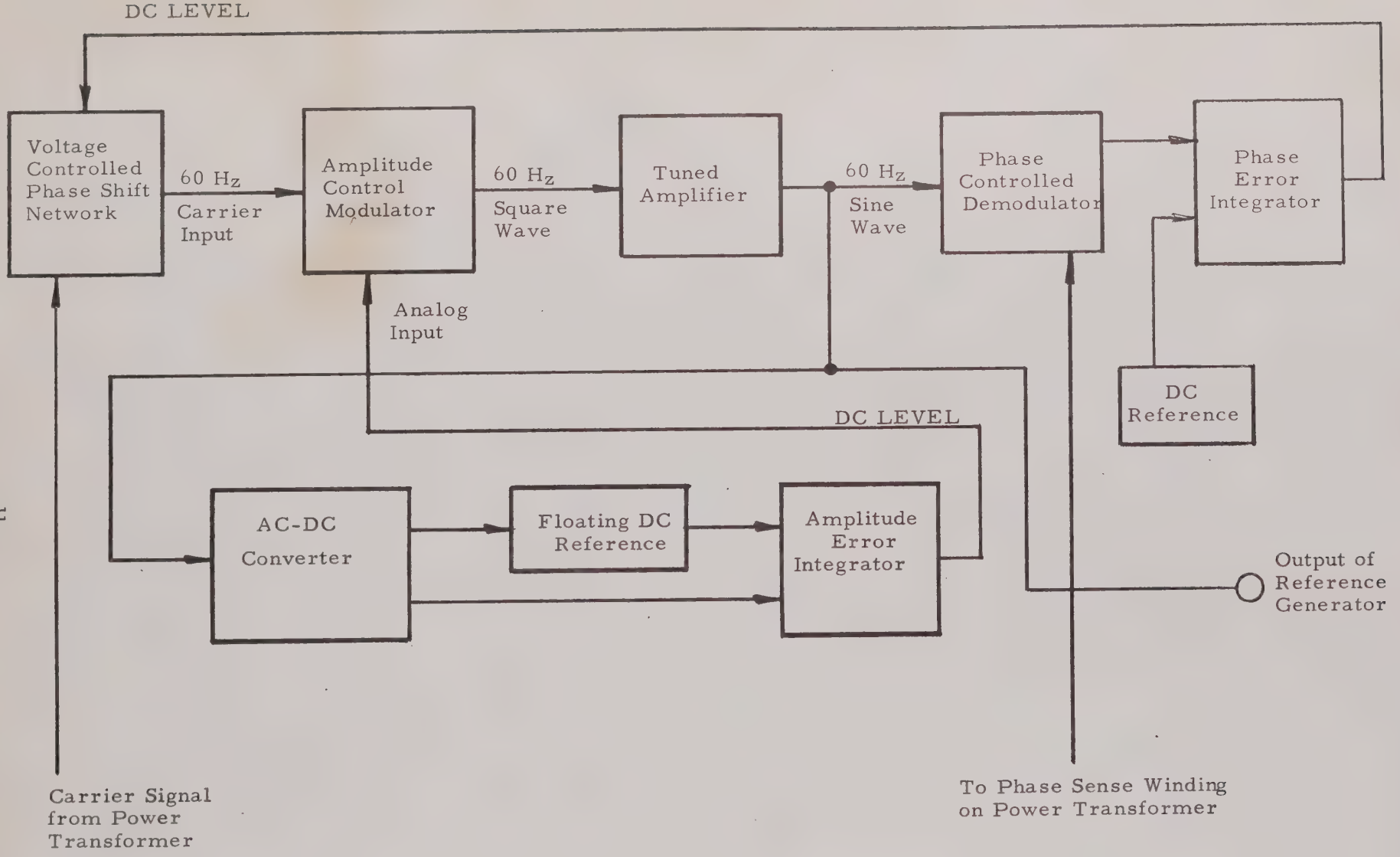


FIGURE 3. Block Diagram for Reference Generator.

The amplitude control system consists of a tuned amplifier, an AC-DC converter, a floating DC reference, an amplitude error integrator and the amplitude control modulator connected in a closed feedback loop. The difference between the AC-DC converter output and the DC reference is integrated and applied as the analog input to the modulator operating at a 60 Hz carrier frequency. The output of the modulator is used to drive a tuned amplifier which is resonant at 60 Hz. The output of this tuned amplifier is the desired output of the reference generator.

The phase control servo system consists of the same tuned amplifier, a phase controlled demodulator, a different DC reference voltage, a phase error integrator, a voltage controlled phase shift network and the carrier input to the amplitude control modulator connected in a closed feedback loop. The difference between the phase controlled demodulator output and its associated DC reference is integrated and used to drive a voltage controlled phase shift network. This phase servo is then used to compensate for variations in the phase shift of the tuned circuit with time, temperature and slight variations (± 5 per cent) in the incoming AC line frequency.

4.2.1.1 AMPLITUDE CONTROL MODULATOR

The amplitude control modulator consists of switching transistor A1Q2 and associated components. The base of A1Q2 is driven by the phase corrected 60 Hz signal. The collector of A1Q2 is driven by the DC output of the amplitude error integrator through resistor A1R21. The square wave at the collector of A1Q2 is used to drive the first stage of the tuned amplifier and has an amplitude of 1.5 volts peak-to-peak.

4.2.1.2 TUNED AMPLIFIER

The tuned amplifier consists of transistors A1Q3, A1Q4, A1Q10, A1Q11, A1Q13, A1Q14, A1Q15 and associated components. The input to the tuned amplifier is the square wave as generated by the amplitude control modulator. This input signal is applied to the base of transistor A1Q3.

Transistors A1Q3 and A1Q4 are connected in the emitter follower configuration and provide a gain of approximately 1.0 to the square wave signal. The series resonant circuit, consisting of A1L1 and A1C10, is used to remove harmonics from the square wave and to provide a voltage gain of approximately 6.0 (ratio of peak-to-peak square wave input to peak-to-peak sine wave output) at 60 Hz. The output of the first series resonant circuit contains a total harmonic distortion of approximately 5 to 10 per cent. This series resonant circuit is tuned to 63 Hz according to the procedure given in section 5.3 of this instruction manual.

Transistors A1Q10 and A1Q11 are also connected in the emitter follower configuration and provide a gain of approximately 1.0 to the distorted 60 Hz sine wave. The series resonant circuit, consisting of A1L2 and A1C14 is used to reduce the harmonic content in the 60 Hz sine wave to less than 0.15 per cent. This tuned circuit provides a voltage gain of approximately 2.2 at 60 Hz (ratio of peak-to-peak pure sine wave output to peak-to-peak distorted sine wave input). This series resonant circuit is tuned to 55 Hz according to the procedure given in Section 5.3 of this instruction manual.

Transistors A1Q13A, A1Q14 and A1Q15 are connected as a feedback amplifier whose closed loop gain is 1.0. This amplifier is used to sense the output of the second tuned circuit and to provide power for driving the AC-DC converter, the phase control demodulator and the correction amplifier. Transistor A1Q13B is used to provide a DC level equal to the DC level at the collector of A1Q15. This DC level is used to drive one side of the correction amplifier. Potentiometer A1R43 is normally adjusted so that the DC component in the output of the Model 1360 Dynamic Line Corrector is less than ± 20 millivolts.

4.2.1.3 AC-DC CONVERTER

The AC-DC converter consists of transistors A1Q5, A1Q6, A1Q7, A1Q8, A1Q9 and associated components connected as a direct coupled DC amplifier. Diodes A1CR2 and A1CR3 are located in the feedback loop of this amplifier and are used to provide a differential DC output from the AC-DC converter. The closed loop gain of the AC-DC converter is approximately 0.90 (ratio of differential DC output to rms sine wave input). Potentiometer A1R8 is used to adjust the output of the dynamic line corrector to exactly 115 volts rms.

4.2.1.4 DC REFERENCE POWER SUPPLY

The DC reference power supply consists of transistor A1Q12, zener diodes A1CR4, A1CR5 and associated components. Transistor A1Q12 is used as a constant current source and drives temperature compensated zener diode A1CR4. The DC output of this reference supply (across A1CR4) is 6.2 volts ± 5 per cent. The output of the DC reference supply is connected in series with the differential output of the AC-DC converter. The difference between the DC reference output and the AC-DC converter output is used to drive the amplitude error integrator.

4.2.1.5 AMPLITUDE ERROR INTEGRATOR

The amplitude error integrator consists of transistors A1Q16, A1Q17, A1Q18, A1Q19, A1Q20 and associated components connected as a direct coupled DC amplifier. Capacitors A1C16 and A1C17 form a differential integrating circuit around the amplifier. The output of the amplitude error integrator is a +6 to +9 volt DC level (with 1.0 volt peak-to-peak 120 Hz ripple) which is used as the analog input to the amplitude control modulator.

If the gain of the tuned circuit should vary due to changes in temperature, power line frequency, or aging, the amplitude error integrator will compensate for the change and provide a constant output from the tuned amplifier.

4.2.1.6 PHASE CONTROL DEMODULATOR

The phase control demodulator consists of dual-emitter transistor A1Q21 and associated components. The carrier input to this demodulator is derived from the phase sensing winding on the power transformer. This shunt demodulator connects the junction of resistors A1R61 and A1R69 to ground during alternate one-half cycles of the 60 Hz AC line. Capacitors A1C22, A1C23 and resistors A1R64 and A1R65 form a 90 degree phase lag network at 60 Hz. This network compensates for the 90 degree phase shift normally associated with this type of phase correcting servo system. Diodes A1CR9, A1CR10, A1CR11 and A1CR12 are used to amplitude limit the magnitude of the output of the phase control demodulator. This, in turn, effectively reduces the gain of the phase control system to amplitude variations in the signal at the collector of transistor A1Q15.

4.2.1.7 PHASE ERROR INTEGRATOR

The phase error integrator consists of transistors A1Q22, A1Q23, A1Q24, A1Q25, A1Q26, A1Q27 and associated components connected as a direct coupled DC amplifier. Capacitor A1C24 forms an integrating circuit around this amplifier. The phase error integrating amplifier has a differential input with the base of A1Q22 connected to a DC level controlled by potentiometer A1R67. Potentiometer A1R67 is used to adjust the phase of the reference generator output so that the correction signal at A2TP1 has a minimum value.

The base of A1Q23 is driven by the output of the phase control demodulator. The difference between these two input signals is integrated by capacitor A1C24 and the resulting DC signal is applied to the voltage controlled phase shift network.

4.2.1.8 VOLTAGE CONTROLLED PHASE SHIFT NETWORK

The voltage controlled phase shift network consists of a lamp-photocell A1VR1, transistors A1Q1, A1Q28 and associated components. The DC level at the collector of A1Q27 is used to excite the lamp contained in A1VR1. This DC voltage is nominally between +5 volts and +7 volts DC. The resistance of the photocell decreases as the light intensity is increased and thereby changes the phase shift of the 60 Hz signal applied to the base of transistor A1Q1. Potentiometer A1R1 adjusts the DC level at the emitter of A1Q1. This emitter DC level is normally set to approximately 0.6 volts DC to provide a symmetrical square wave at the collector of A1Q2.

4.2.2 CORRECTION AMPLIFIER

The correction amplifier is a direct coupled DC amplifier with a differential operational feedback loop. The closed loop frequency response of this amplifier extends from DC to beyond 200 KHz.

Mechanically, the correction amplifier is split up into five sections. First, a small signal section located on printed circuit board number 1360-701. This section is designated as the A2 assembly. Second, four power transistor sections located on the large heatsinks. These four power transistor sections are designated as the A4, A5, A6 and A7 assemblies.

Electrically, the correction amplifier is split up into three sections. These are: a pre-amplifier, a power amplifier, and the overload circuits.

4.2.2.1 POWER AMPLIFIER

The power amplifier section of the correction amplifier consists of transistors A2Q8, A2Q9, A2Q10, A2Q11, A4Q1 through A4Q7, A5Q1 through A5Q7, A6Q1 through A6Q7, A7Q1 through A7Q7 and associated components connected in a quasi-complementary symmetry series output configuration. This configuration provides a current gain of approximately 10,000 and a voltage gain of 1.0.

Transistors A4Q1 through A4Q7, A5Q1 through A5Q7 and associated components supply the output current during positive half-cycles of the correction signal. The peak current is in the order of +37 amperes when the dynamic line corrector is fully loaded to 3000 VA output. These positive output transistors and their associated heatsink can dissipate over 800 watts when mounted in the air stream of the cooling fan for any length of time. Transistor A4Q1 is connected in the emitter follower configuration and is used to supply base drive to this section of the output stage.

Transistors A6Q1 through A6Q7, A7Q1 through A7Q7 and associated components supply the output current during negative half-cycles of the correction signal. The peak current is in the order of -37 amperes when the dynamic line corrector is fully loaded to 3000 VA output. These negative output transistors and their associated heatsink can also dissipate over 800 watts when mounted in the air stream of the cooling fan for any length of time. Transistor A6Q1 is connected in the emitter follower configuration and is used to supply base drive to this section of the output stage.

Transistors A2Q8 and A2Q11 form a pair of constant current sources referenced to the +45 volt and -45 volt power supplies, respectively. Transistor A2Q8 supplies approximately 6 milliamperes for driving the base of A2Q9 and the collector of A2Q7. Transistor A2Q9 is used in the emitter follower configuration and provides a current gain of approximately 50 for driving the positive half-cycle amplifier in the heatsink assembly. Tran-

sistor A2Q10 is used in the grounded emitter configuration and provides a current gain of approximately 50 for driving the negative half-cycle amplifier in the heatsink assembly. Diodes A2CR14 through A2CR16 are used to set the static current through the quasi-complementary symmetry output stage.

The junction of A2CR15 and A2CR16 is used as the input point as it has the same DC level as the output of the power amplifier.

4.2.2.2 PREAMPLIFIER

The preamplifier section of the correction amplifier consists of transistors A2Q1, A2Q2, A2Q3, A2Q4, A2Q5, A2Q7 and associated components connected in a direct coupled differential circuit configuration. The input stage of this preamplifier is a dual pair, A2Q1, connected as a differential amplifier. This stage has a gain of approximately 50 at DC. The second stage of the preamplifier, transistors A2Q2 and A2Q3, is also connected as a differential amplifier and has a gain of approximately 15 at DC. A differential local feedback loop, consisting of A2C3, A2C4, A2C5, A2C6, A2R9 and A2R12, is used to reduce the high frequency loop gain of these two stages. The third stage of the preamplifier, transistors A2Q4 and A2Q5 are connected in the emitter follower and grounded emitter configurations respectively. This stage provides a gain of 10 at DC and converts the differential input signal to a single-ended signal to drive transistor A2Q7. Diodes A2CR3 through A2CR7 are used to limit the peak current through A2Q4 and A2Q5 during overload conditions.

Transistor A2Q7 is used in the grounded emitter configuration and provides a voltage gain of approximately 150 at DC. A local feedback loop, consisting of A2R17 and A2C7, is connected to the base of A2Q7 and provides a 6 db per octave roll-off above 1000 Hz.

4.2.2.3 OVERLOAD CIRCUITS

The overload section of the correction amplifier is used to protect the correction amplifier during overload. Semiconductor device A2Q6 is a triac which is activated by a control signal applied to Pin 10 of the preamplifier circuit board. During normal operation, the triac is an open circuit and does not affect operation of the correction amplifier. During overload, the emitter of the triac is gated "on" and base 2 of the triac is clamped to ground. This, in turn, causes the voltage at the junction of A2CR15 and A2CR16 to go to zero volts. The output of the correction amplifier also goes to zero volts as it tracks the voltage at the junction of A2CR15 and A2CR16.

During overload, the output of the correction amplifier is also clamped to ground by a pair of power triacs, Q1 and Q2 located on the main chassis of the line corrector. The static current in the output stage is significantly reduced

and the dynamic line corrector delivers unregulated power through the series circuit formed by the power winding S3 of the power transformer and the power triacs Q1 and Q2.

4.2.3 POWER SUPPLY

The power supply circuits are located on printed circuit board number 1360-702 (Assembly A3 and on the chassis of the dynamic line corrector.

The +45 volt supply is mounted directly to the chassis of the dynamic line corrector and supplies unregulated +45 volts at 12 amperes average current (37 amperes peak) to the correction amplifier when the line corrector is delivering 3000 VA. Under this condition, the ripple on the +45 volt supply is approximately 3 volts peak-to-peak at 120 Hz.

The -45 volt supply is also mounted directly to the chassis of the dynamic line corrector and supplies unregulated -45 volts at 12 amperes average current to the correction amplifier when the line corrector is delivering 3000 VA. Under this condition, the ripple on the -45 volt supply is approximately 3 volts peak-to-peak at 120 Hz.

The +21 volt supply is contained on the power supply circuit board and consists of transistor A3Q1 and associated components. The +21 volt supply delivers 75 milliamperes with less than 10 millivolts peak-to-peak ripple at 120 Hz.

The -21 volt supply is contained on the power supply circuit board and consists of transistor A3Q2 and associated components. The -21 volt supply delivers 75 milliamperes with less than 10 millivolts peak-to-peak ripple at 120 Hz.

The +26 volt supply is contained on the power supply circuit board and delivers 80 milliamperes to drive the OVERLOAD lamp.

4.2.4 OVERLOAD SENSING CIRCUITS

The overload sensing circuitry is located on the power supply board and consists of transistors A3Q3 through A3Q12 and associated components. This circuitry is broken down into the following sections:

a) Rectifier and Filter Circuit.

b) Schmitt Trigger and Level Shift Circuit.

c) Flip-flop Circuit.

d) Zero Crossing Detector Circuit.

e) Delay Circuit.

OVERLOAD CIRCUITRY

The rectifier and filter circuit consists of diodes A3CR8, A3CR9, A3C6 and associated components. Under full load current conditions, the rectified output voltage across A3C6 is approximately 5 volts DC with .5 volt peak-to-peak of 120 Hz ripple.

The Schmitt trigger and level shift circuits consist of transistors A3Q5, A3Q6, A3Q7 and associated components. A DC level of approximately 5.5 volts at the base of A3Q5 will activate the Schmitt trigger and cause A3Q6 to be biased into cutoff. This, in turn, causes A3Q7 to be driven into saturation. When the overload is removed the voltage at the base of A3Q5 will drop below 5 volts and the collector of A3Q7 will return to +21 volts.

The flip-flop circuit consists of transistors A3Q8, A3Q9 and associated components. With no overload signal present, the collector of A3Q8 is in saturation and the emitter of A3Q10 is at zero volts ± 0.2 volts. When an overload occurs, the emitter of A3Q10 is biased to approximately +10 volts which, in turn, activates the circuitry described in Section 4.2.2.3 of this instruction manual.

In order to restore normal line corrector operation, it is necessary that the flip-flop be reset. This can only be accomplished at the instant that the error amplifier output is crossing zero volts with a negative slope. Transistors A3Q3, A3Q4 and associated components are connected in a configuration which detects the zero crossing and generates a level shift output. The negative going edge of this level shift will be conducted through diode A3CR12 and reset the flip-flop provided that both the collector of A3Q7 and A3Q12 are at +21 volts.

During initial application of power to the line corrector, the collector of A3Q12 is biased to zero volts by means of the current flow through capacitor A3C12. This delay circuit holds the collector of A3Q12 to zero volts for approximately 2 seconds and allows the amplitude and phase servo loops in the reference boards to stabilize before any load current is drawn from the power amplifier. This reduces the electrical stress on the output transistors during start-up and thereby provides more reliable operation.

WARNING

Voltages up to 125 VAC are available in certain sections of this line corrector. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with the primary power circuits and the 115 volt AC output circuit of the line corrector.

CALIBRATION PROCEDURE

5.1 GENERAL

The following calibration procedure, or any part of it, may be performed on a routine basis to insure that the dynamic line corrector remains within specified tolerances. This procedure should always be performed after any repairs have been made to the unit. This procedure also covers test methods for the following line corrector specifications:

a) Output voltage and adjustment.

b) Output voltage instability including temperature coefficient.

c) Power output.

d) Harmonic distortion.

e) Line regulation.

f) Load regulation.

g) Transient characteristics.

5.2 TEST EQUIPMENT REQUIRED

The following test equipment is required to perform the calibration procedure:

a) Oscilloscope, Tektronix 533 A with W plug-in.

b) 5 KVA Variac, General Radio W50M or equivalent.

c) 5 KVA wattmeter, Simpson Electric Model 392 or equivalent.

d) Distortion analyser, H.P. 330B or equivalent.

e) Differential voltmeter, Fluke 883A or equivalent.

f) Load box, 3000 watts and 600 watts.

g) Expanded scale (about 115 VAC strip chart recorder), Voltron model 89.038 or equivalent.

h) Multimeter, Simpson 260 or equivalent.

i) Three 1 ohm, 225 watt adjustable power resistors connected in parallel.

j) 250VA Power Source, California Instruments Model 251T with 45/75Hz plug-in or equivalent.

5.3 REFERENCE BOARD ADJUSTMENTS

The reference board has four adjustable potentiometers and two adjustable inductors. DO NOT adjust the variable inductors unless an appropriate variable frequency power source is available. Some

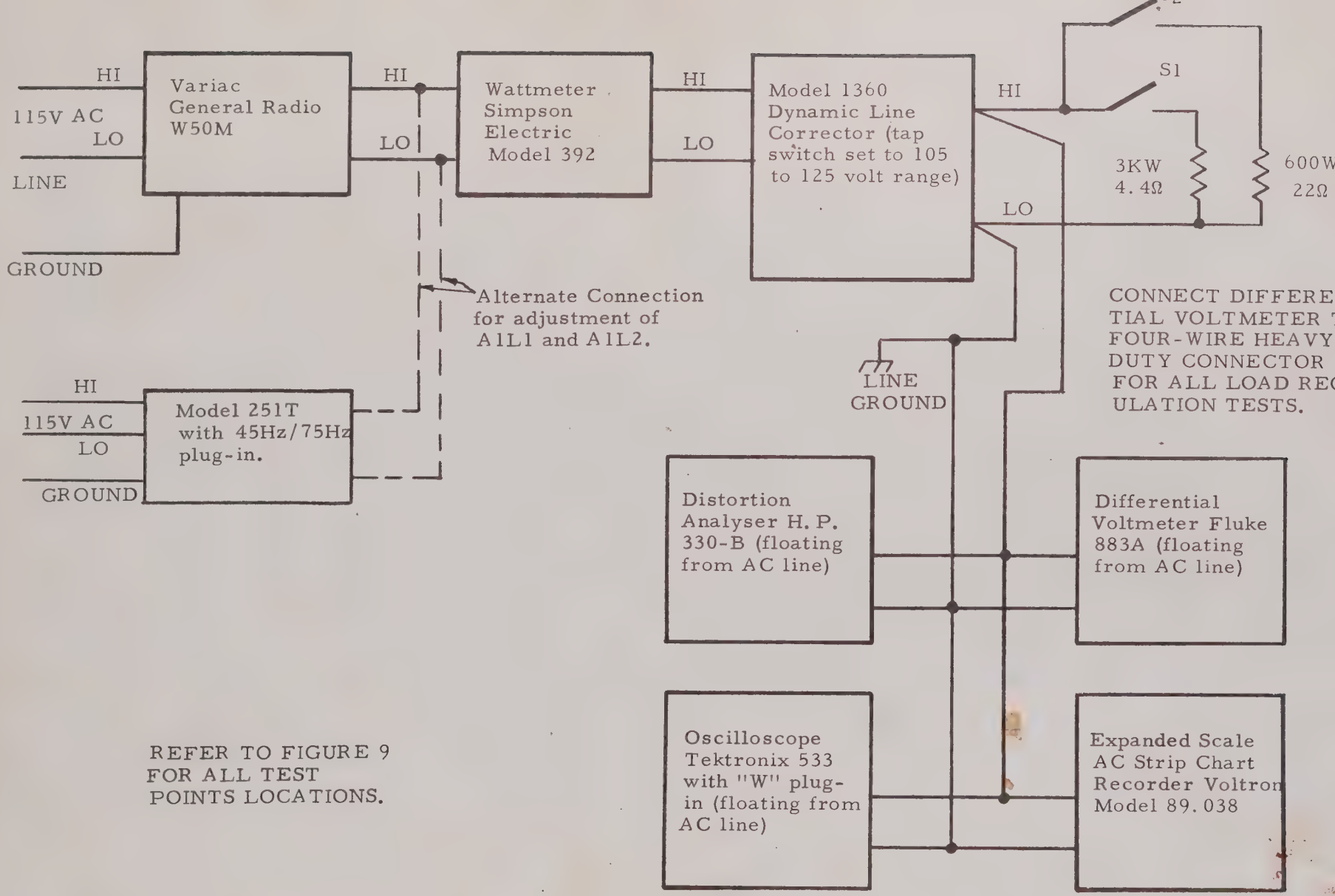


FIGURE 4. Test Circuit for Model 1360 Dyanmic Line Corrector

of these adjustments will interact with one another. The following procedure should be carefully followed when making these adjustments:

5.3.1 Connect the Model 1360 Dynamic Line Corrector to the wattmeter and California Instruments Model 251T Power Source as shown in the alternate connection in Figure 4.

5.3.2 Remove the preamplifier board A2 from the line corrector during initial adjustments on the reference board.

5.3.3 Apply power to the California Instruments 251T Power Source and adjust its output to 115 volts at 63 Hz. Apply power to the line corrector and allow the circuits to stabilize for a few minutes. The wattmeter should indicate less than 80 watts with the preamplifier board removed.

5.3.4 Connect the high lead of the oscilloscope to the collector of A1Q20 (A1TP1) and ground the oscilloscope at A1TP6. Adjust inductor A1L1 for a minimum DC signal on the oscilloscope.

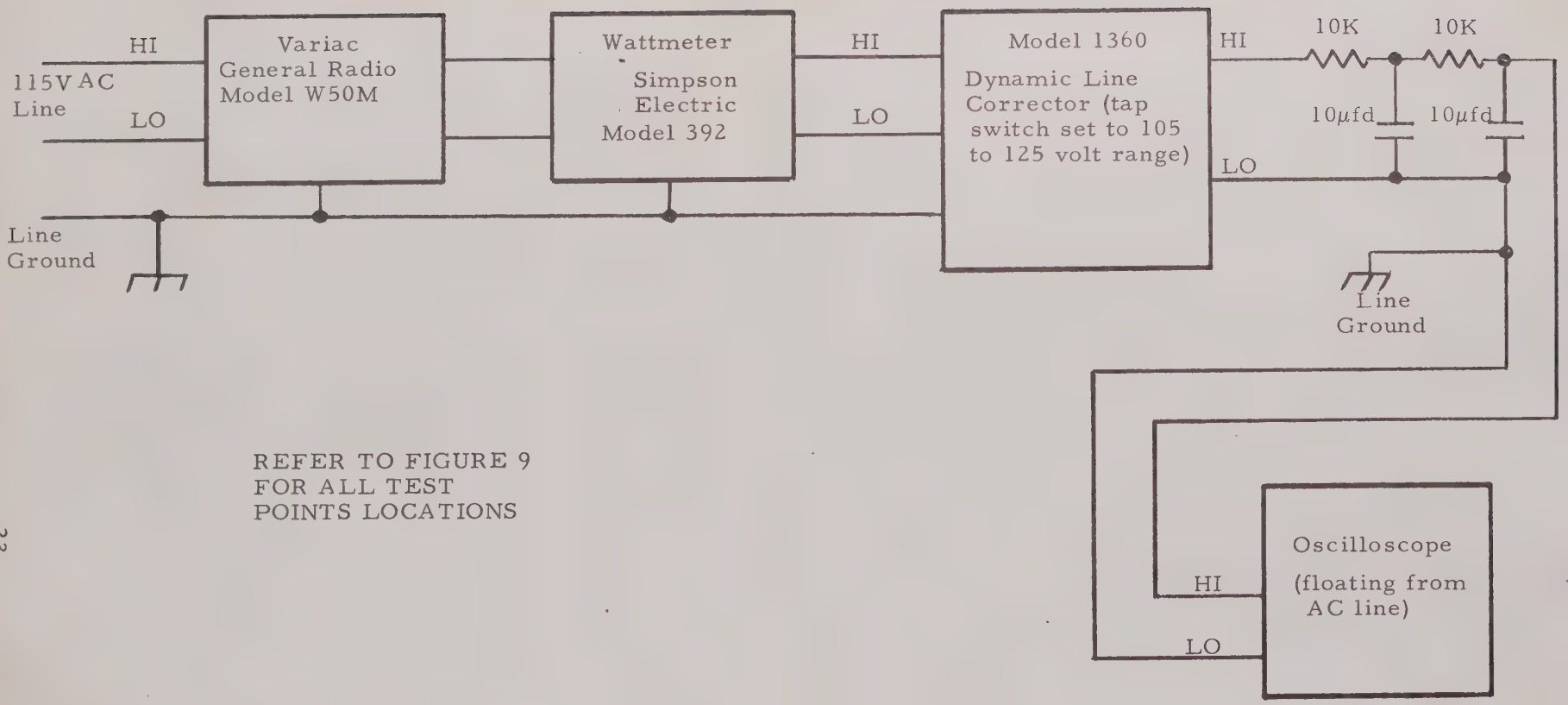
5.3.5 Adjust the output of the California Instruments 251T Power Source to 115 volts at 55 Hz. Adjust inductor A1L2 for a minimum DC signal on the oscilloscope.

5.3.6 Repeat steps 5.3.4 and 5.3.5 as there may be a slight amount of interaction in these adjustments. The voltage at A1TP1 should remain less than +9.0 volts DC with 1 volt of peak-to-peak ripple as the line frequency is slowly varied from 57 to 63 Hz.

5.3.7 Apply 115 volts 60 Hz to the input of the line corrector and connect the high input of the differential voltmeter to the emitter of A1Q1 (A1TP3) on the reference board and ground the differential voltmeter at A1TP6 on the reference board. Adjust potentiometer A1R1 on the reference board so that the meter indicates 0.6 volt DC ± 0.1 volt.

5.3.8 Connect the differential voltmeter to A1TP4 and the low side to A1TP6. With the input line frequency set to 57 Hz, the differential voltmeter should read greater than +2.5 volts DC. With the input line frequency set to 63 Hz, the differential voltmeter should read less than +9.5 volts. With the input line frequency set to 60 Hz, the differential voltmeter should read +6 volts ± 1.0 volts. Readjust A1L1 and A2L2 slightly, if required. This completes the adjustment procedure for the inductors A1L1, A1L2 and potentiometer A1R1.

5.3.9 Remove power from the line corrector and then discharge filter capacitors C2 through C5 through a 5 ohm power resistor. Place the preamplifier board A2 in the line corrector and then apply 115 volts 60 Hz to the input of the line corrector from the 251T power source. The wattmeter should indicate approximately 100 to 250 watts with no load on the output of the line corrector.



REFER TO FIGURE 9
FOR ALL TEST
POINTS LOCATIONS

FIGURE 5. Test Circuit for Adjusting the DC Component in the Output of the Line Corrector Equal to Zero.

5.3.10 Connect the high lead of the oscilloscope to A2TP1 on the preamplifier board. Adjust the phasing potentiometer A1R67 on the reference board for a minimum signal (minimum 60 Hz line frequency component) on the oscilloscope. Rocking the output voltage of the California Instruments 251T Power Source in the range from 105 to 115 volts may also help to remove the line frequency component from the oscilloscope display.

5.3.11 Connect a low pass filter (100K ohms and 10 μfd) in series with the oscilloscope input and connect this to the output of the line corrector as shown in Figure 5. Adjust potentiometer A1R43 on the reference board so that the DC components of the oscilloscope display is less than ± 20 millivolts.

5.3.12 Adjust the AC output voltage potentiometer A1R8 so that the output voltage (at the rear of the line corrector) is 115 volts ± .15 per cent.

5.3.13 This completes the initial adjustments on the reference board. The line corrector is ready to be connected to a load. Replace the California Instruments Model 251T Power Source with the 60 Hz AC line and Variac.

5.3.14 Set the Variac to 115 volts output and apply the 3 KW load to the output of the line corrector. The wattmeter should indicate approximately 4200 to 4800 watts.

5.3.15 Repeat step 5.3.10 except maintain full load on the output of the dynamic line corrector. The minimum signal should appear on the oscilloscope with the Variac somewhere between 105 and 110 volts output. Rock the Variac and potentiometer A1R67 together until a point has been found where the fundamental component (60 Hz) indicated on the oscilloscope display is practically zero.

5.3.16 Repeat steps 5.3.7, 5.3.11 and 5.3.12 under full load conditions. Very little change should be required in any of these adjustments.

5.4 POWER SUPPLY BOARD ADJUSTMENT

The power supply board has only one adjustment potentiometer. This potentiometer A3R12 is used to set the load current level that will activate the overload circuits. The following procedure should be followed when adjusting this potentiometer:

5.4.1 Connect the Model 1360 Dynamic Line Corrector to the 115 volt AC line in series with the Variac and the wattmeter as shown in Figure 4. Apply power and allow the unit to stabilize for a few minutes. Apply a 3600 watt load and adjust the input line voltage to 115 volts with the Variac. Adjust potentiometer A3R12 on the power supply board until the OVERLOAD light just turns completely "on".

5.5 OUTPUT VOLTAGE STABILITY AT CONSTANT LINE, LOAD AND TEMPERATURE

5.5.1 Connect the Model 1360 Dynamic Line Corrector as shown in Figure 4 and connect the 3000 watt load to the output. Apply power to the line corrector and adjust the input line voltage to 115 volts AC.

5.5.2 Start the strip chart recorder and record the drift during a 24 hour period. This drift should be less than ± 57 millivolts rms. Disregard the drift during the first one hour, as this represents initial warm-up drift. Care should be taken to insure that the ambient temperature is held constant at ± 3 degrees C for this test.

5.6 OUTPUT VOLTAGE TEMPERATURE COEFFICIENT

5.6.1 Place the Model 1360 Dynamic Line Corrector in a large environmental chamber and connect as shown in Figure 4. Connect the 3000 watt load to the output of the line corrector. Apply power to the line corrector, and adjust the input line voltage to 115 volts AC. Allow the line corrector to warm-up for one hour while maintaining the ambient temperature at 25 degrees C.

5.6.2 After one hour, record the AC reading of the differential voltmeter for future reference.

5.6.3 Raise the ambient temperature of the environmental chamber to 50 degrees C and allow the line corrector to stabilize for one hour. Maintain the ambient temperature in the chamber at 50 degrees C ± 2 degrees C. After one hour, record the AC output of the line corrector with the differential voltmeter.

5.6.4 The difference in output voltage between steps 5.6.2 and 5.6.3 must be less than 144 millivolts rms.

5.7 LINE REGULATION

5.7.1 Connect the Model 1360 Dynamic Line Corrector as shown in Figure 4 and connect the 3000 watt load to the output. Apply power to the line corrector and adjust the input line voltage to 105 volts AC. Record the AC output of the line corrector with the differential voltmeter.

5.7.2 Increase the input line voltage to 125 volts AC and record the output of the line corrector with the differential voltmeter.

5.7.3 The difference in the output voltage of the line corrector between steps 5.7.1 and 5.7.2 must be less than 57 millivolts rms.

5.8 LOAD REGULATION

5.8.1 Connect the line corrector as shown in Figure 4, and connect the 3000 watt load to the output. Apply power to the dynamic

line corrector and adjust the input line voltage to 115 volts AC. Record the AC output of the dynamic line corrector with the differential voltmeter. Check that the differential voltmeter is connected to the heavy duty four-wire output connector for this test.

5.8.2 Remove the 3000 watt load from the output of the line corrector. Readjust the input voltage to the line corrector to 115 volts AC, if necessary. Record the AC output of the line corrector with the differential voltmeter.

5.8.3 The difference in output voltage between steps 5.8.1 and 5.8.2 must be less than 29 millivolts rms.

5.8.4 The above procedure may be repeated for 105 volt and 125 volt AC line voltages, if required.

5.9 HARMONIC DISTORTION

5.9.1 Connect the Model 1360 Dynamic Line Corrector as shown in Figure 6. Provision should be made for connecting the distortion analyser and differential voltmeter to either the input of the line corrector or to the output of the line corrector.

5.9.2 Apply power to the circuit in Figure 6 and allow to warm-up for 2 minutes under full load.

5.9.3 Connect the input of the distortion analyser and the input of the differential voltmeter as shown in switch position B. Check that the output of the line corrector is 115 volts ± .15 per cent.

5.9.4 Connect the input of the distortion analyser and the input of the differential voltmeter as shown in switch position A. Adjust the 750 ohm rheostat until the total harmonic distortion is 10 per cent. Adjust the Variac so that the input line voltage is 105 volts ± .5 per cent.

5.9.5 Connect the distortion analyser to switch position B and measure the output distortion. The total harmonic distortion must be less than 0.2 per cent.

5.9.6 Repeat steps 5.9.4 and 5.9.5 except adjust the Variac so that the input line voltage to the line corrector is 125 volts ± .5 per cent. The total harmonic distortion at the output of the line corrector must be less than 0.2 per cent.

5.10 STEP LINE CHANGE

5.10.1 Connect the Model 1360 Dynamic Line Corrector as shown in Figure 7 and close switches S1 and S2. Apply power to the line corrector and allow a 2 minute warm-up under full load.

5.10.2 Adjust the Variac so that the input voltage to the line corrector is 115 volts. Open switch S1, the input voltage to the line corrector should drop to 105 volts ± 1 volt. Adjust R1 slightly, if the input voltage is below 105 volts.

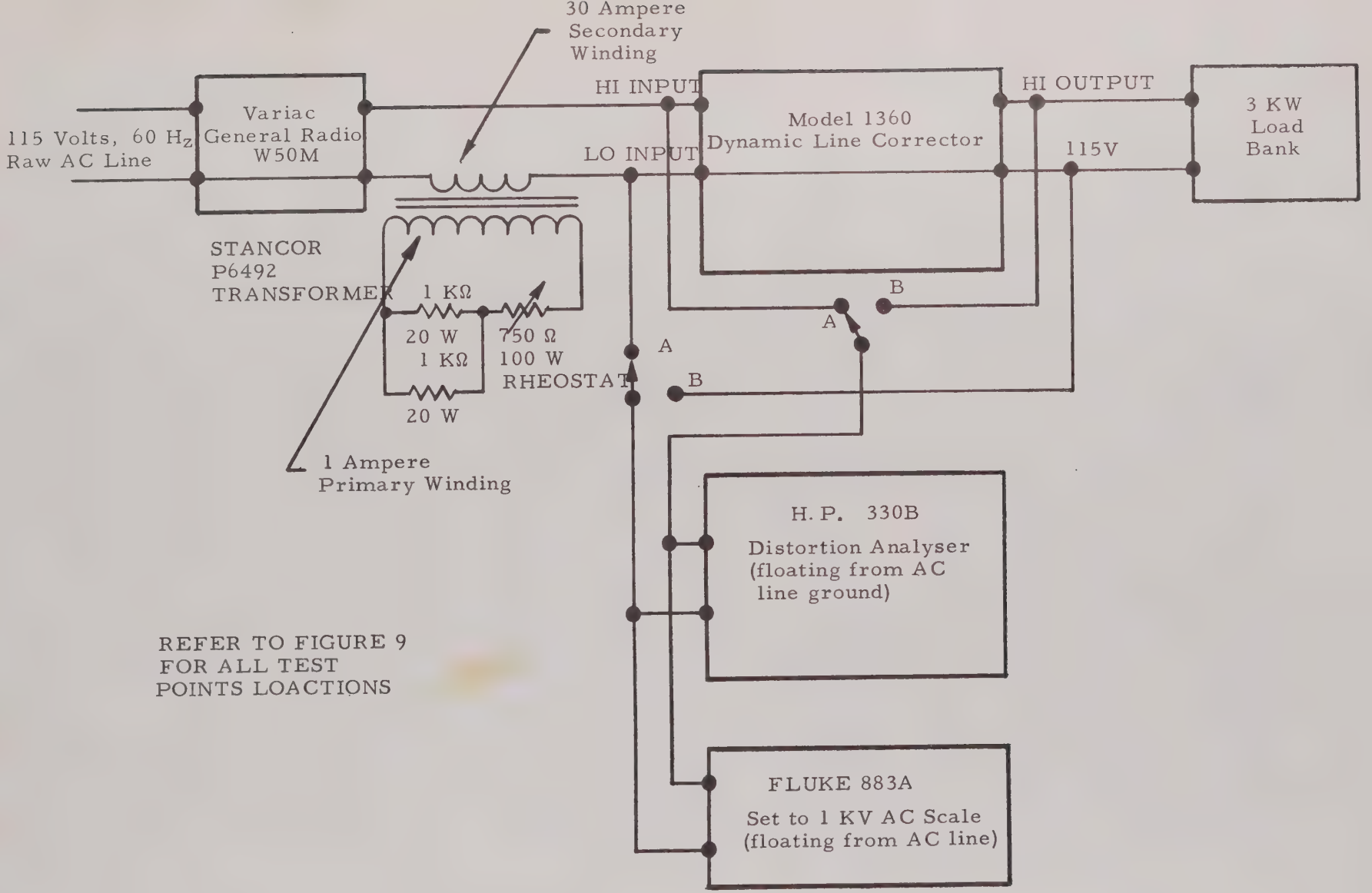


FIGURE 6. Harmonic Distortion Test Circuit for Model 1360 Dynamic Line Corrector

5.10.3 Set the oscilloscope on the .2 second per centimeter ranges and adjust the "W" plug-in to observe the positive peaks of the sine wave at a sensitivity of .1 volt per centimeter.

5.10.4 Manually close S1 at such a time so as to observe the switching transient at the output of the line corrector. The peak transient should not exceed .8 volt and should recover to .08 volt of final value within .5 seconds.

5.10.5 Repeat 5.10.4 except observe the switching transient while S1 is opened. The peak transient should not exceed .8 volt and should recover to .08 volt of final value within .5 seconds.

5.10.6 Repeat 5.10.2 except adjust the Variac to 125 volts at the input of the line corrector with S1 closed. Open switch S1, the input voltage to the line corrector should drop to 115 volts ± 1 volt. Adjust R1 slightly, if the input voltage is below 115 volts.

5.10.7 Repeat steps 5.10.3, 5.10.4 and 5.10.5. The peak transient should not exceed .8 volt and should recover to .08 volt of final value within .5 seconds.

5.11 STEP LOAD CHANGE

5.11.1 Connect the Model 1360 Dynamic Line Corrector as shown in Figure 7 and close switch S1 and switch S2. Apply power to the line corrector and allow a 2 minute warm-up under full load.

5.11.2 Adjust the Variac so that the input voltage to the line corrector is 115 volts. Open switch S2, the input voltage to the line corrector should not increase more than 2 volts. If the line voltage increases more than 2 volts, connect the equipment to an AC power line system with greater current handling capacity.

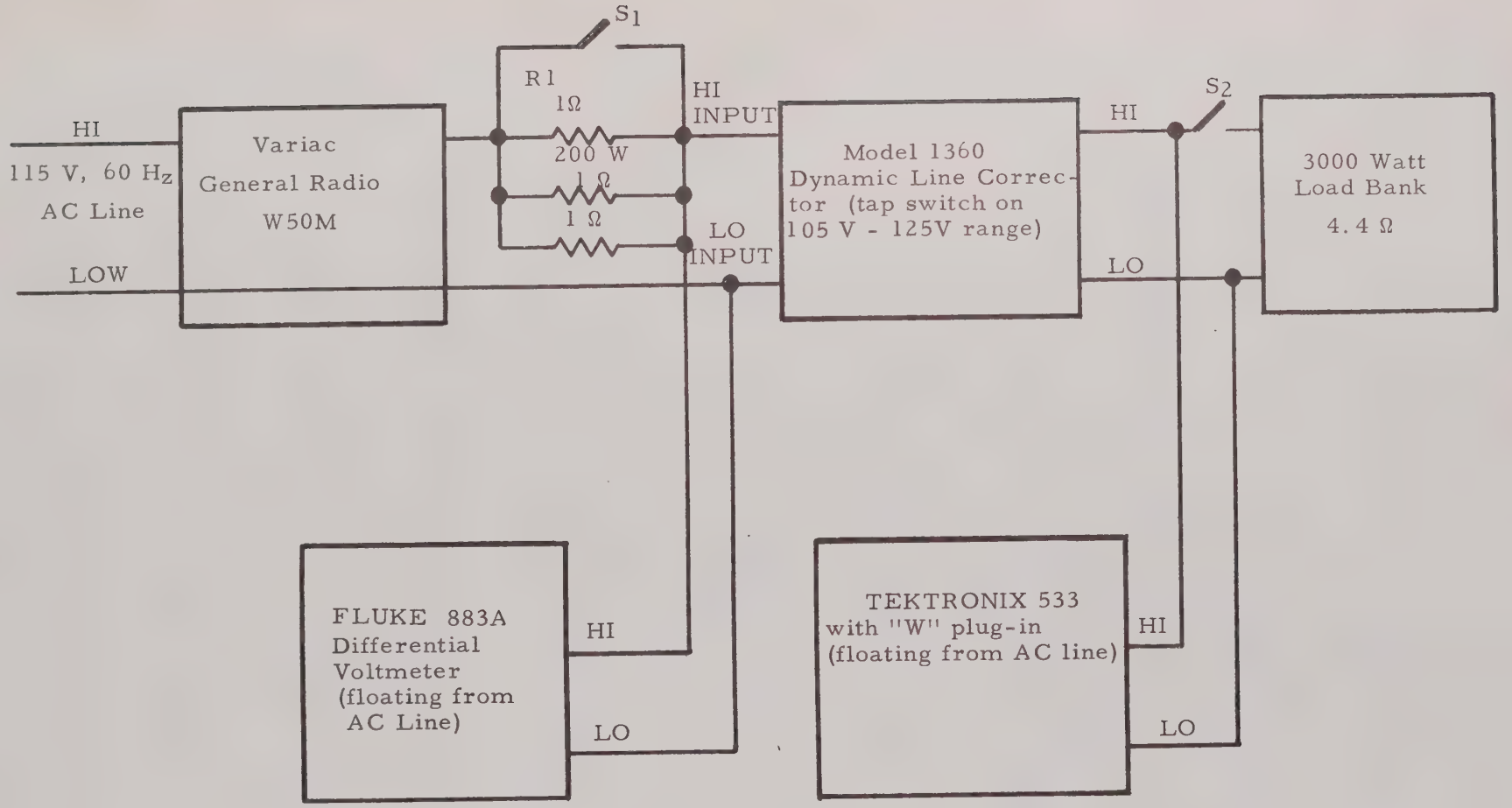
5.11.3 Set the oscilloscope on the .2 second per centimeter range and adjust the "W" plug-in to observe the positive peaks of the sine wave at the sensitivity of .1 volt per centimeter.

5.11.4 Manually close S2 at such a time so as to observe the switching transient at the output of the line corrector. The peak transient should not exceed .8 volt and should recover to .08 volt of final value within 0.5 seconds.

5.11.5 Repeat 5.11.4 except observe the switching transient as switch S2 is opened. The peak transient should not exceed .8 volt and should recover to .08 volt of final value within 0.5 seconds.

5.12 CYCLE TO CYCLE PEAK AMPLITUDE INSTABILITY

5.12.1 Connect the line corrector as shown in Figure 7 and close switch S1 and S2. Apply power to the line corrector and allow a 2 minute warm-up under full load.



REFER TO FIGURE 9
FOR ALL TESTS
POINTS LOCATIONS

FIGURE 7. Test circuit for measuring step line and load response of line corrector.

5.12.2 Adjust the Variac so that the input voltage to the line corrector is 115 volts.

5.12.3 Connect the oscilloscope to the input of the line corrector so that one cycle of the 60 Hz line is spread across 10 centimeters in the horizontal direction (1.66 milliseconds per centimeter). Operate the oscilloscope in the + slope internal line sync mode of operation. Expand the sweep about the negative slope zero crossing in the center of the oscilloscope screen until the vertical sensitivity is at least 1 volt per division and the X100 sweep multiplier is in the X100 position. Observe the peak-to-peak jitter in the horizontal direction on the oscilloscope. This jitter must be less than 1.0 centimeter peak-to-peak (16.6 microseconds or ± 0.18 degrees).

5.12.4 Connect the oscilloscope to the output of the line corrector and set the oscilloscope on the 0.1 second per centimeter scale, set the sweep multiplier to X1, adjust the "W" plug-in to observe the positive peaks of the sine wave at a sensitivity of 0.1 volt per centimeter. Each centimeter of horizontal sweep will now contain approximately six positive peaks. Check that each peak is no greater than .032 volt different than the adjacent peak. It may be desirable to repeak this test at sweep rates of .05 second per centimeter and .2 second per centimeter.

5.12.5 Repeat step 4.12.4 except set the "W" plug-in to observe the negative peak of the sine wave.

5.12.6 If step 5.12.3 indicated a greater jitter than ± 0.18 degree, then the cycle-to-cycle amplitude instability indicated in steps 5.12.4 and 5.12.5 will be proportionally greater.

5.13 IMPULSE SETTLING TIME

This test is to insure that the Model 1360 Dynamic Line Corrector has the required high frequency response to attenuate high frequency line and load transients. This test is normally run for load transients only, but gives valid results for line transients.

5.13.1 Connect the above equipment as shown in Figure 8. Turn on the +6 volt and -20 volt power supplies. The +6 volt supply should draw negligible current at this time. The -20 volt supply should draw approximately 80 to 100 milliamperes.

5.13.2 Turn on the pulse generator and synchronize its output to the incoming 115 volt AC line. Adjust the pulse width to 1 millisecond and its amplitude to +6 volts. The +6 volt supply should now deliver approximately 150 ma.

5.13.3 With switch S1 open, apply line power to the line corrector. Check that the output of the line corrector is 115 volts ± .15 per cent. Also, adjust the Variac so that the input to the line corrector is 115 volts.

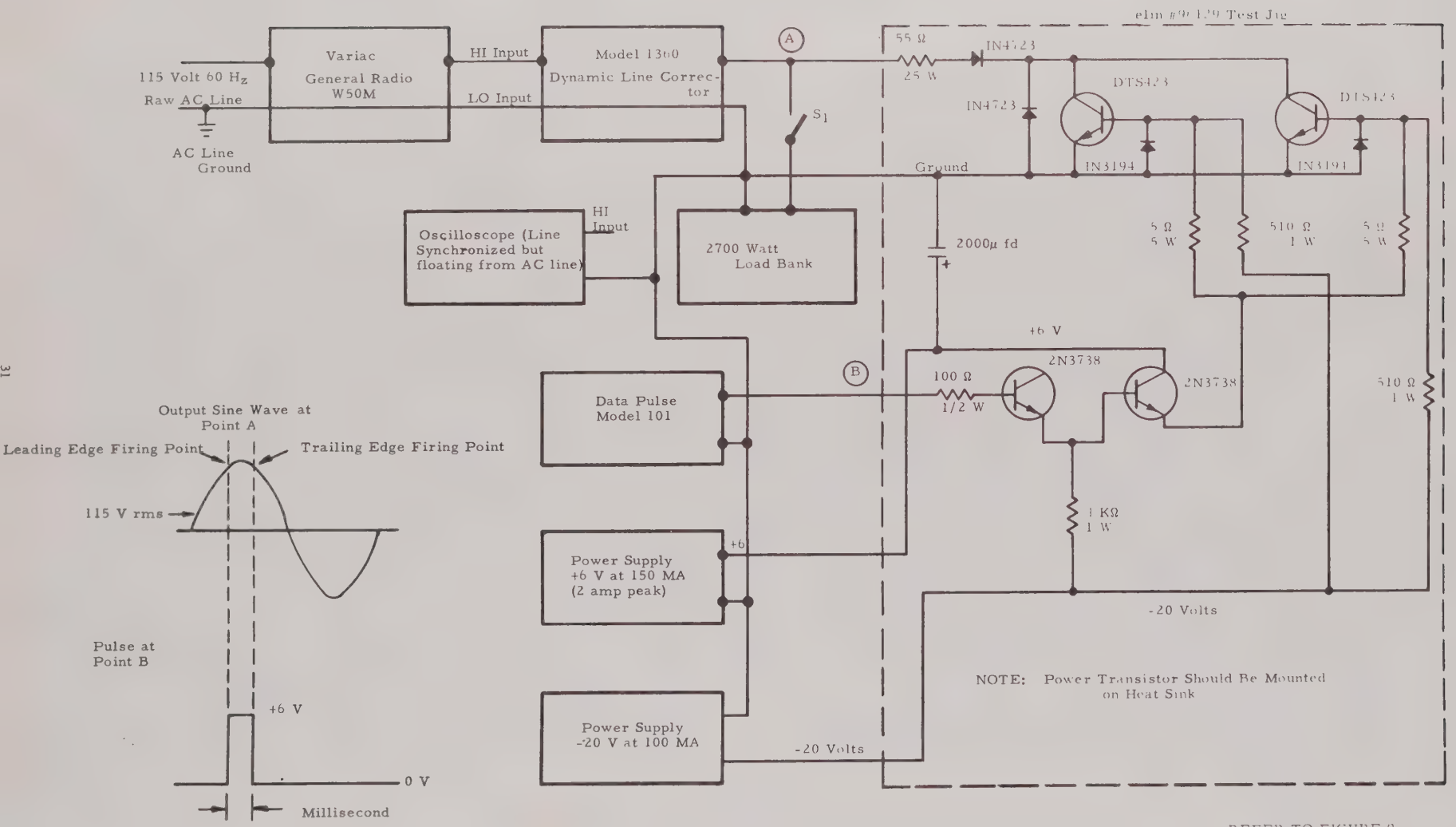


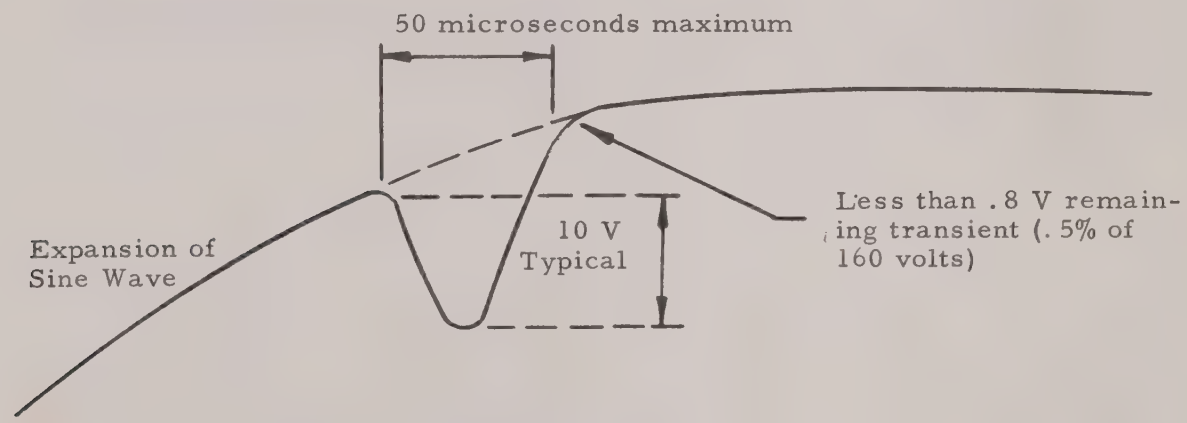
FIGURE 8. Response Time Test Circuit

REFER TO FIGURE 9 FOR ALL TEST POINTS LOCATIONS

5.13.4 Adjust the delay time of the pulse generator so that the 1 millisecond output pulse is synchronized with the positive peak of the 115 volt sine wave output of the line corrector as shown in Figure 8.

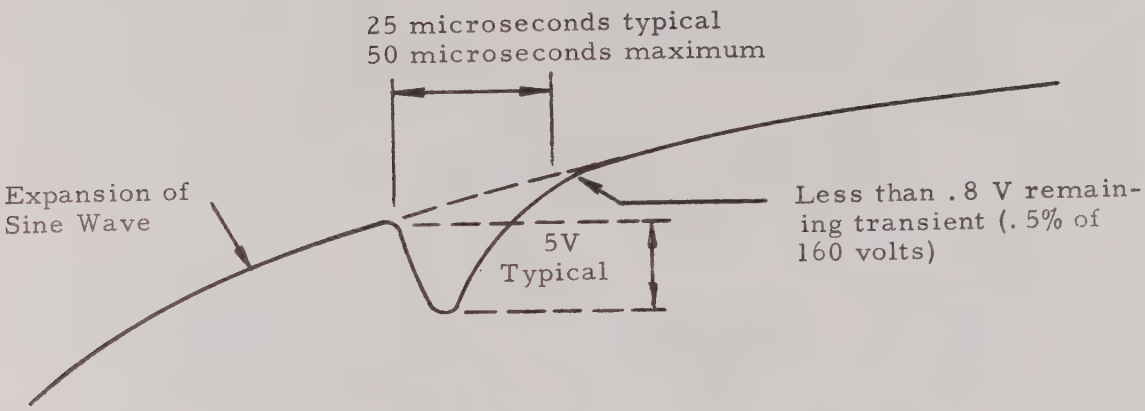
5.13.5 At this time, the California Instruments #96129 test jig will draw a 3 ampere, 1 millisecond current pulse from the output of the line corrector during the positive peak of each cycle.

5.13.6 Connect the high input of the oscilloscope to point A and expand the oscilloscope display in both time and amplitude about the "Leading Edge Firing Point". Expand the sweep rate until the effective sweep rate is 100 microseconds per centimeter at the "Leading Edge Firing Point". Expand the vertical sensitivity until the effective sensitivity is 5 volts per centimeter at the "Leading Edge Firing Point". The following transient should be observed at the "Leading Edge Firing Point".



The length of this transient must be less than 50 microseconds to 0.5 per cent of voltage value (160 volts).

5.13.7 Close switch S1 so that the line corrector has a 2700 watt static load. Readjust the oscilloscope slightly about the "Leading Edge Firing Point", if required. The Leading Edge transient will now be considerably less in both magnitude and duration and is indicated on the following page:



The length of this transient must be less than 50 microseconds to 0.5 per cent of voltage value (160 volts).

5.13.8 This test may be repeated on the "Trailing Edge Firing Point", if desired. Generally, the transient at this point will be somewhat less in magnitude and duration.

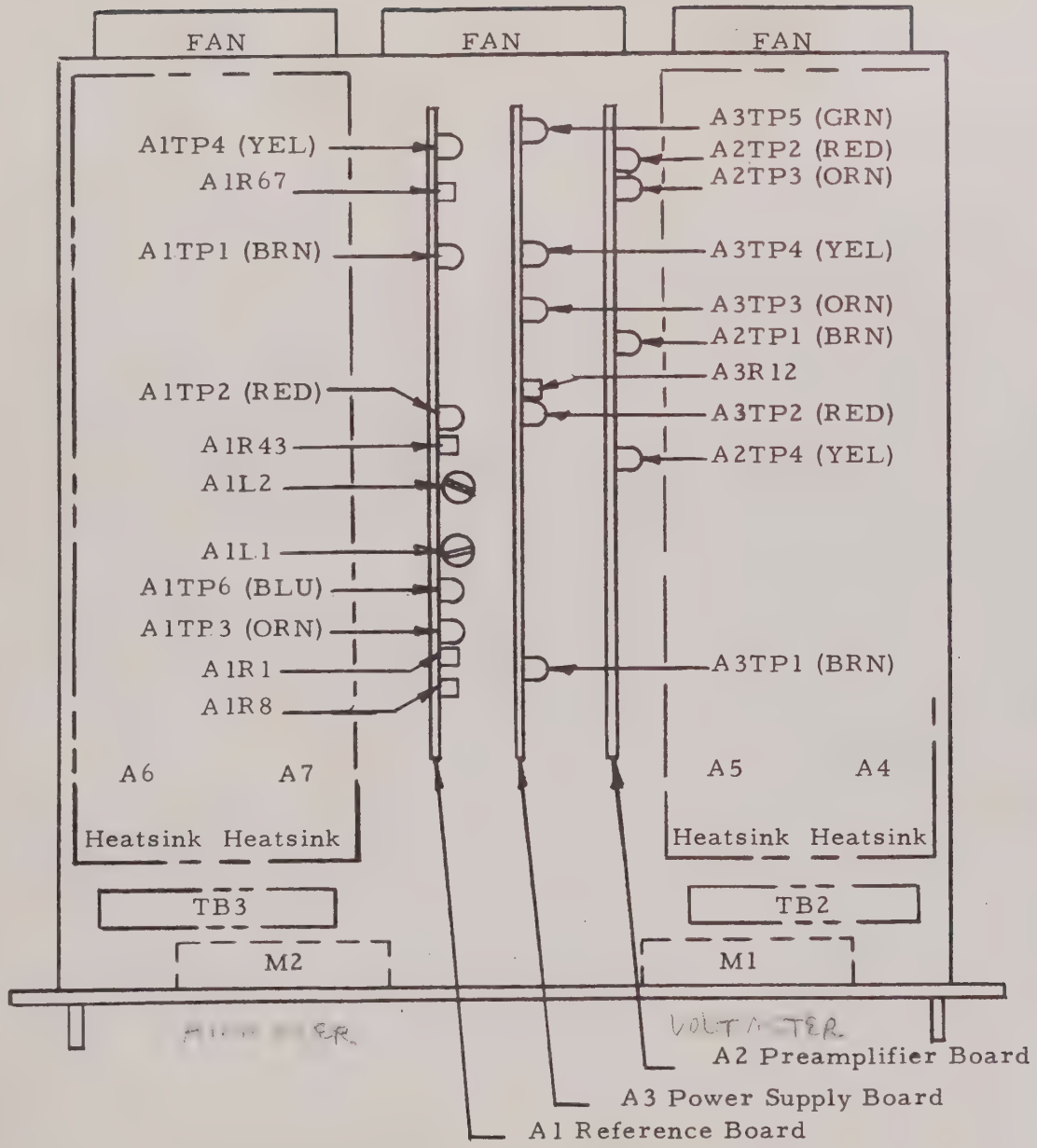


FIGURE 9. Adjustments and Test Points for Model 1360 Dynamic Line Corrector

MAINTENANCE AND TROUBLESHOOTING

6.1 GENERAL

The California Instruments Model 1360 Dynamic Line Corrector is a reliable solid state unit that should require a minimum of maintenance. However, it is forced air cooled and will accumulate some dust with time. The power transistor heatsink should receive a forced air bath at intervals not to exceed six months.

6.2 TROUBLESHOOTING

6.2.1 If a problem appears in the line corrector, it must be isolated to a specific section of the unit. Before servicing the line corrector, check that the AC power input to the unit is of the proper amplitude and frequency. Check that the output load on the line corrector is not excessive.

6.2.2 If the problem has been resolved to be in the line corrector, check that all DC power supply voltages are correct. Figure 9 indicates the location of all adjustments and test points.

6.2.3 Check that the correct error signal is present at test point A2TP1.

6.2.4 Check that the output of the reference generator is a pure sine wave and phase locked to the AC line. The signal at A2 pin 21 must be 180 degrees out of phase with the signal at A2 pin 19.

6.2.5 Check that the overload circuits are operating properly. The overload signal may be disconnected at A3 Pin 1 in order to resolve a further problem in this section of the line corrector.

6.2.6 The THEORY OF OPERATION and CALIBRATION PROCEDURE contained in this manual should be of considerable value in further isolating the cause of any problem.

CAUTION

Voltages up to 125 VAC are available in certain sections of this line corrector. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with the primary power circuits and the 115 volt AC output circuit of the line corrector.

CIRCUIT DIAGRAMS

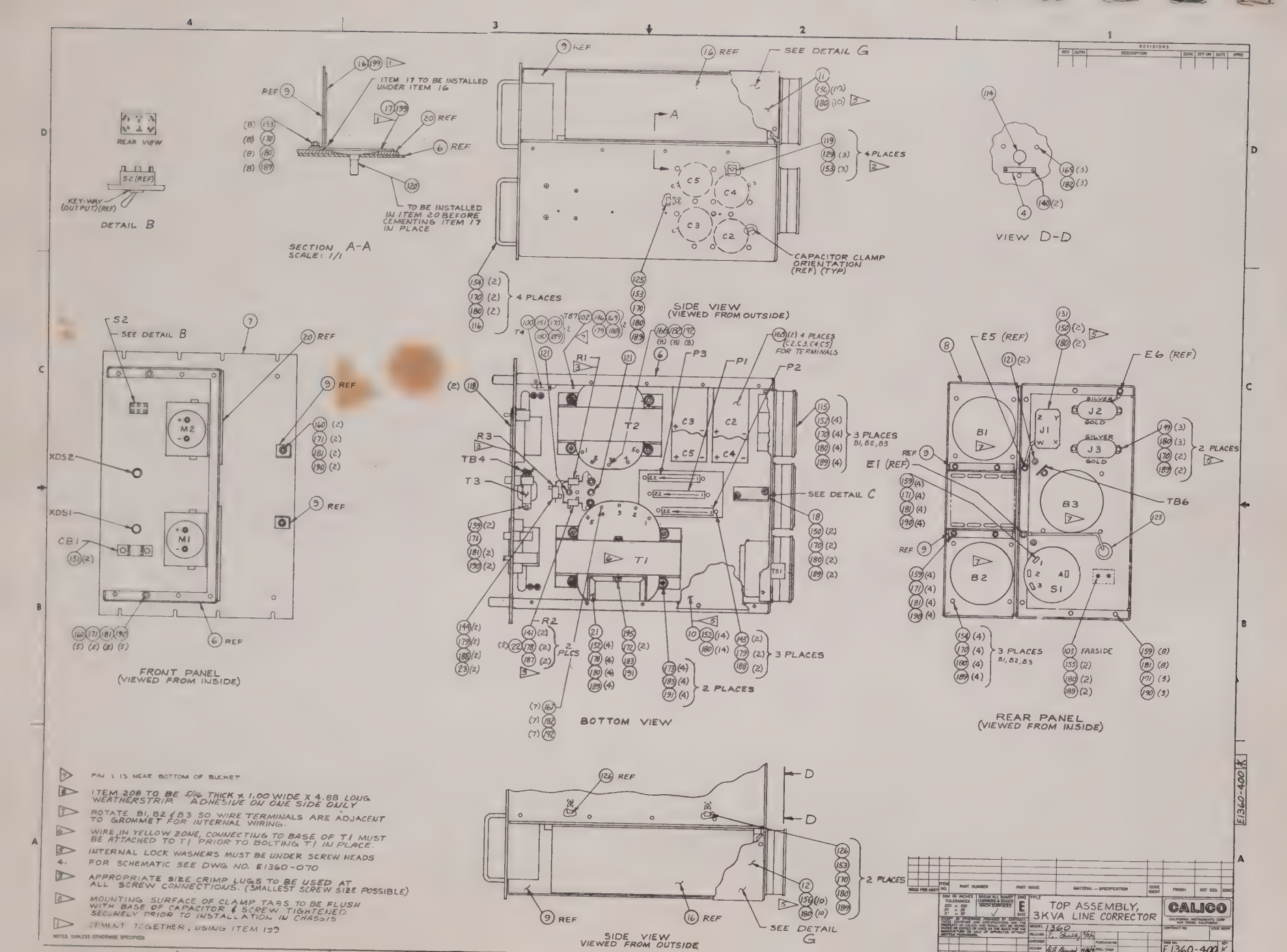
7.1 GENERAL

This section contains schematic and mechanical diagrams necessary for operation and maintenance of the 1360 Dynamic Line Corrector. The schematic diagram illustrates the circuit while the mechanical assemblies indicate the part placement.

7.2 REFERENCE DESIGNATIONS

Partial reference designators are shown on schematics and mechanical drawings. Prefix these reference designators with assembly and/or sub-assembly designation for the complete reference designator. For example:

Assembly/Sub-Assembly	Component	Complete Designation
A1	C30	A1C30
None	T1	T1
A3	CR1	A3CR1



1. PIN 1 IS NEAR BOTTOM OF BUCKET
2. ITEM 208 TO BE 5/16 THICK X 1.00 WIDE X 4.88 LONG WEATHERSTRIP ADHESIVE ON ONE SIDE ONLY
3. ROTATE B1, B2 & B3 SO WIRE TERMINALS ARE ADJACENT TO GROMMET FOR INTERNAL WIRING.
4. WIRE IN YELLOW ZONE, CONNECTING TO BASE OF T1 MUST BE ATTACHED TO T1 PRIOR TO BOLTING T1 IN PLACE.
5. INTERNAL LOCK WASHERS MUST BE UNDER SCREW HEADS
6. FOR SCHEMATIC SEE DWG. NO. E1360-070
7. APPROPRIATE SIZE CRIMP LUGS TO BE USED AT ALL SCREW CONNECTIONS. (SMALLEST SCREW SIZE POSSIBLE)
8. MOUNTING SURFACE OF CLAMP TABS TO BE FLUSH WITH BASE OF CAPACITOR & SCREW TIGHTENED SECURELY PRIOR TO INSTALLATION IN CHASSIS
9. CEMENT TOGETHER, USING ITEM 199

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	ECO OR	DATE	APPD

TOP ASSEMBLY, 3KVA LINE CORRECTOR

CALICO

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

MODEL 1360

DRAWN: L. Gould, 7/64

CHECKED:

ENGR:

PURCHASING:

PROD. ENGR:

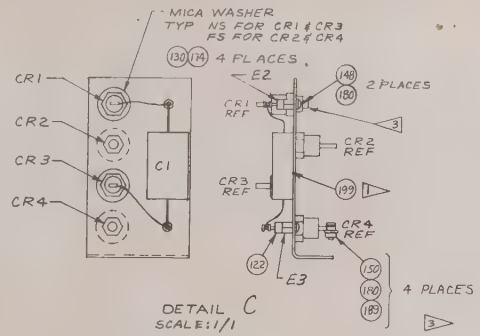
CONTRACT NO.

CODE IDENT

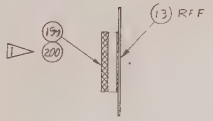
DWG NO. E1360-400 K

REV K

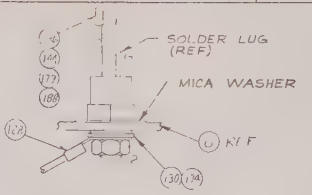
E1360-400 K



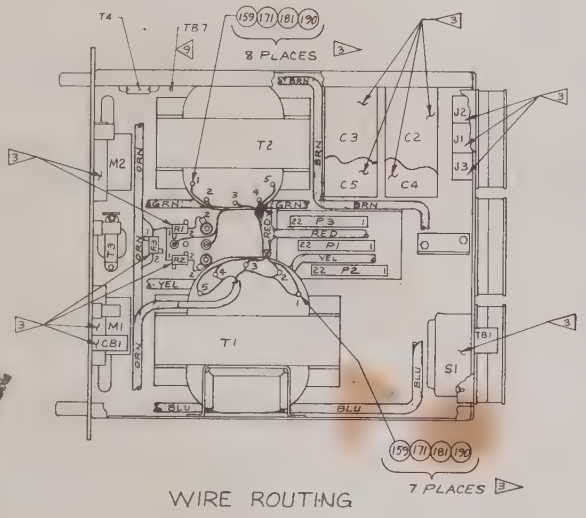
DETAIL C
SCALE: 1/1



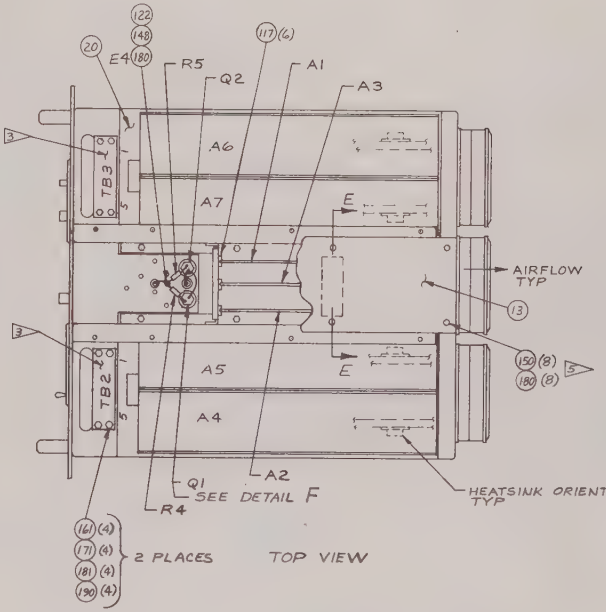
SECTION E-E



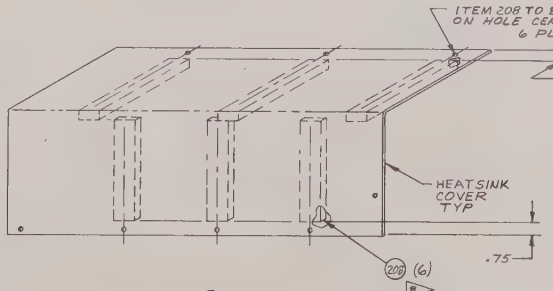
DETAIL F
TYP Q1 & Q2
SCALE: 2/1



WIRE ROUTING



TOP VIEW



DETAIL G
INSTALLATION OF ITEM 208 TO COVER TYP BOTH COVERS

NOTES UNLESS OTHERWISE SPECIFIED

ITEM NO	PART NUMBER	PART NAME	MATERIAL - SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
PEGD PER ASS'Y							

DIM IN INCHES TOLERANCES XXX ± .010 .XX ± .02 .X ± .1 ANG ± 1°

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES

DWG SIZE E

TITLE: TOP ASSEMBLY, 3KVA LINE CORRECTOR

MODEL 1360

RELEASE

CHECKER

DESIGN

DRAFTSMAN

PURCHASING

PROJ ENGR

QUAL ENGR

CALICO
CALIFORNIA INSTRUMENTS CORP
SAN DIEGO, CALIFORNIA

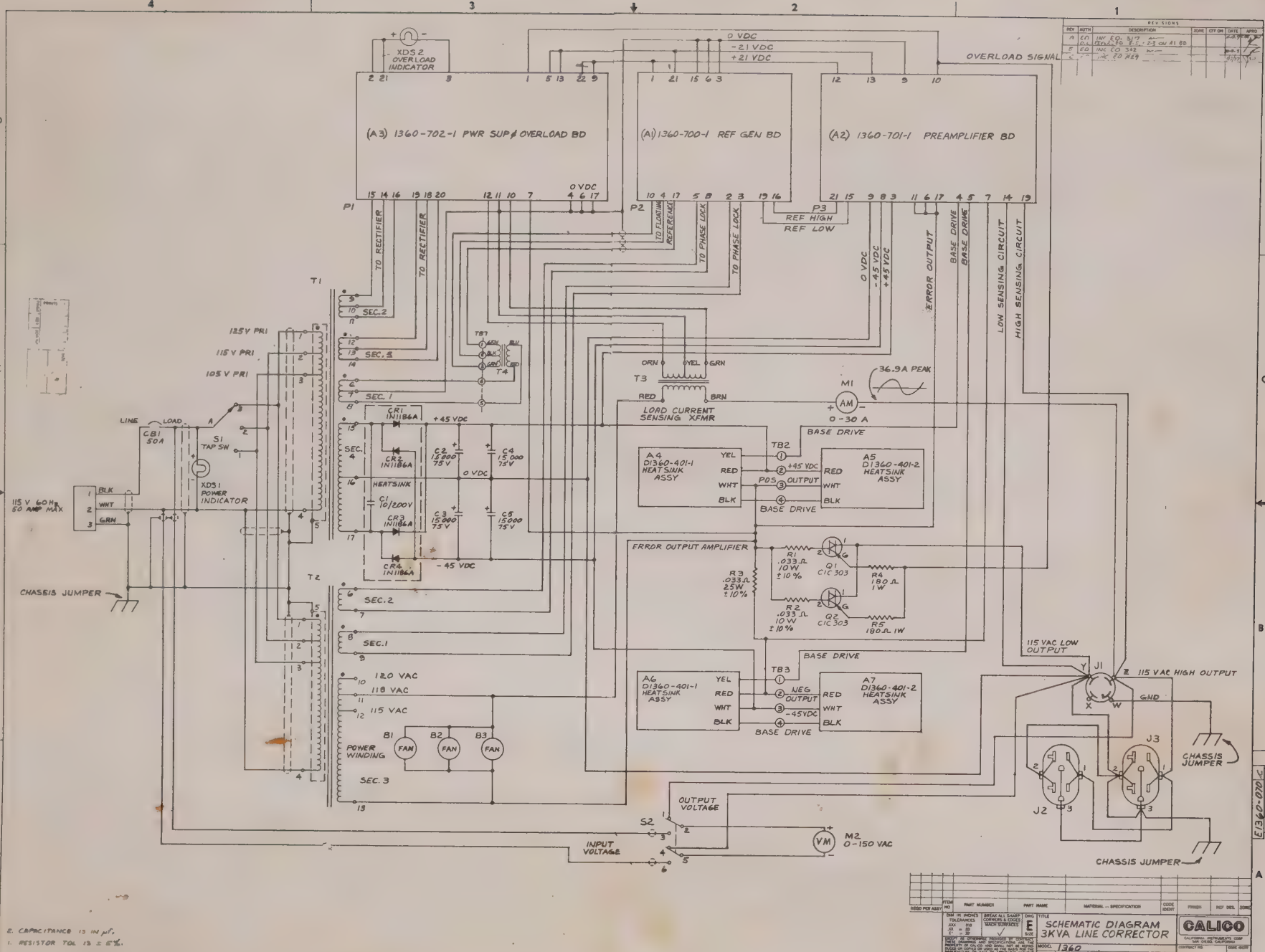
CONTRACT NO

CODE IDENT

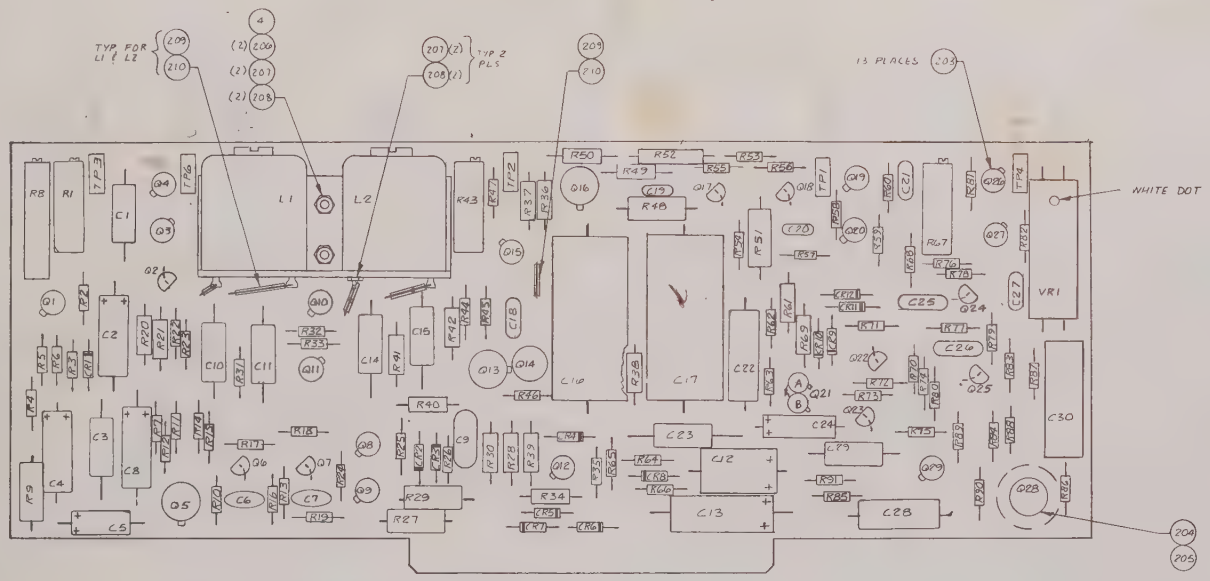
DWG NO E1360-400 REV K

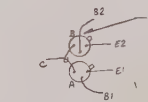
SCALE 1/2 SHEET 3 of 9

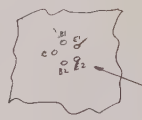
E1360-400 K


XDS 2 OVERLOAD INDICATOR
0 VDC
-21 VDC
+21 VDC
OVERLOAD SIGNAL
(A3) 1360-702-1 PWR SUP & OVERLOAD BD
(A1) 1360-700-1 REF GEN BD
(A2) 1360-701-1 PREAMPLIFIER BD
P1
P2
P3
REF HIGH
REF LOW
TO RECTIFIER
TO RECTIFIER
TO FLOATING REFERENCE
TO PHASE LOCK
TO PHASE LOCK
0 VDC
-45 VDC
+45 VDC
ERROR OUTPUT
BASE DRIVE
BASE DRIVE
LOW SENSING CIRCUIT
HIGH SENSING CIRCUIT
T1
125 V PRI
115 V PRI
105 V PRI
SEC. 2
SEC. 3
SEC. 1
T4
T3
ORN
YEL
GRN
RED
BRN
LOAD CURRENT SENSING XFMR
M1
36.9A PEAK
0-30 A
LINE
LOAD
CB1 50A
S1 TAP SW
XDS1 POWER INDICATOR
115 V 60HZ 50 AMP MAX
BLK
WHT
GRN
CHASSIS JUMPER
CR1 IN1186A
CR2 IN1186A
CR3 IN1186A
CR4 IN1186A
+45 VDC
0 VDC
-45 VDC
HEATSINK
C1 10/200V
C2 12,000 75V
C3 15,000 75V
C4 15,000 75V
C5 15,000 75V
T2
SEC. 2
SEC. 1
120 VAC
118 VAC
115 VAC
POWER WINDING
SEC. 3
B1 FAN
B2 FAN
B3 FAN
A4 D1360-401-1 HEATSINK ASSY
A5 D1360-401-2 HEATSINK ASSY
A6 D1360-401-1 HEATSINK ASSY
A7 D1360-401-2 HEATSINK ASSY
TB2
TB3
YEL
RED
WHT
BLK
+45 VDC
POS OUTPUT
NEG OUTPUT
-45VDC
BASE DRIVE
ERROR OUTPUT AMPLIFIER
R1 .033Ω 10W ±10%
R2 .033Ω 10W ±10%
R3 .033Ω 25W ±10%
Q1 C1C303
Q2 C1C303
R4 180Ω 1W
R5 180Ω 1W
115 VAC LOW OUTPUT
115 VAC HIGH OUTPUT
GND
J1
J2
J3
CHASSIS JUMPER
CHASSIS JUMPER
OUTPUT VOLTAGE
INPUT VOLTAGE
S2
M2
0-150 VAC
E1360-070C
2. CAPACITANCE IS IN μf.
1. RESISTOR TOL IS ± 5%.
NOTES (UNLESS OTHERWISE SPECIFIED)
SCHEMATIC DIAGRAM 3KVA LINE CORRECTOR
CALICO
MODEL 1360
DWG NO E1360-070
REV C

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
		SEE SHEET 1				







A1

BOARD

"REF."

A1

-1 ASSEMBLY

COMPONENT SIDE SHOWN

(COMPONENT SIDE CLAD DELETED FOR CLARITY)

3. ORIENT TRANSISTOR CASE TABS AS SHOWN.

2. BEND LEADS OF ALL LARGE CAPACITORS (ie. C16 & C17) PRIOR TO SOLDERING.

1. FOR SCHEMATIC DIAGRAM, SEE DRAWING No. E1360-071.

NOTES: (UNLESS OTHERWISE SPECIFIED)

REQD PER ASSY	ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
-1		PL 1360-700	PARTS LIST	SHEETS 4 THRU 9				

DIM IN INCHES TOLERANCES: XXX = .010, XX = .03, X° = .30

BREAK ALL SHARP CORNERS & EDGES. MACH SURFACES √

DWG SIZE D

TITLE: ASSY, REFERENCE P.C. BOARD

CALICO — CALIFORNIA INSTRUMENTS CORP, SAN DIEGO, CALIFORNIA

MODEL 1360

CONTRACT NO

CODE IDENT 16067

DWG NO D1360-700

REV D

SCALE 2X

SHEET 2 OF 9

RELEASE

CHECKER

DESIGN

DRAFTSMAN

PURCHASING

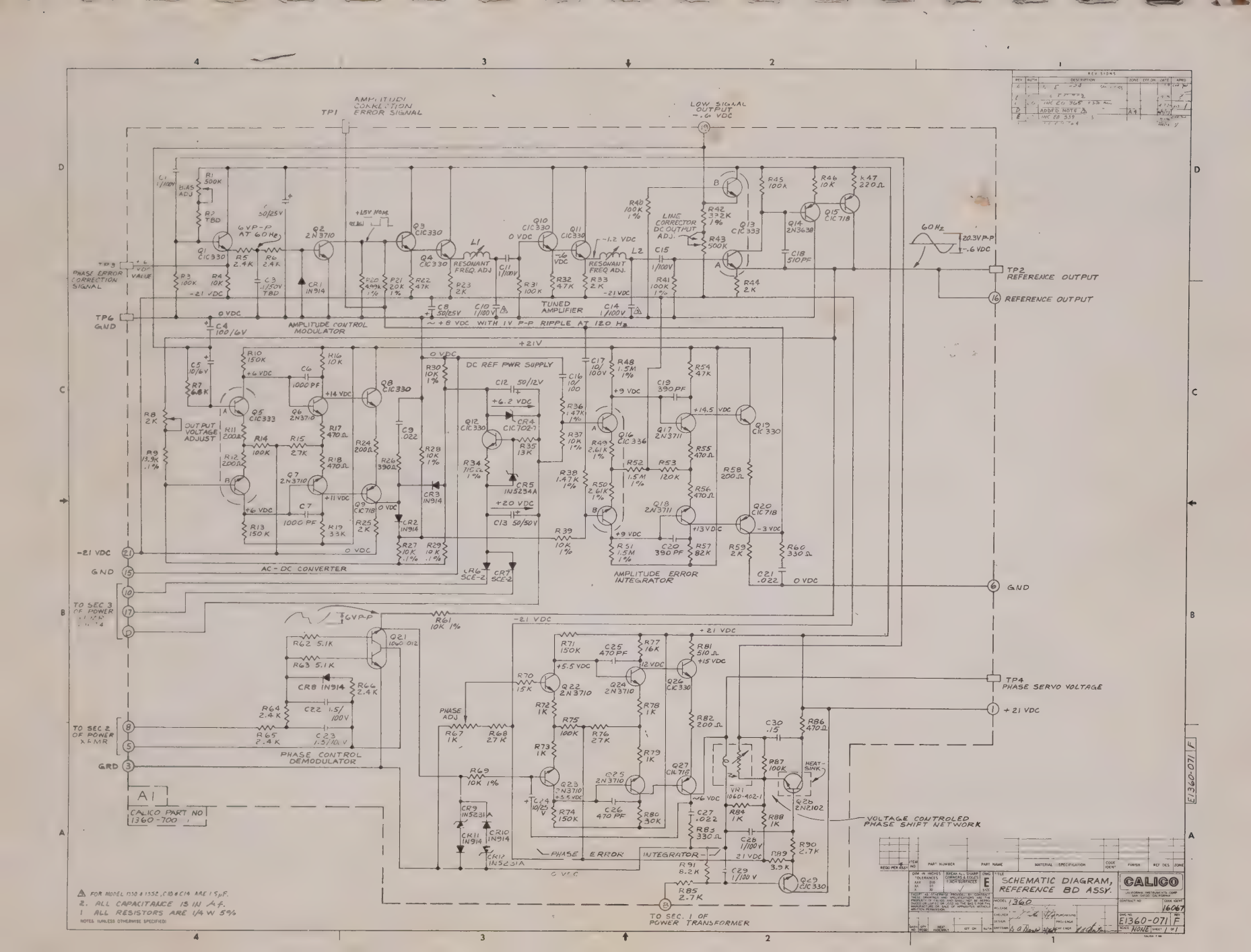
PROJ ENGR

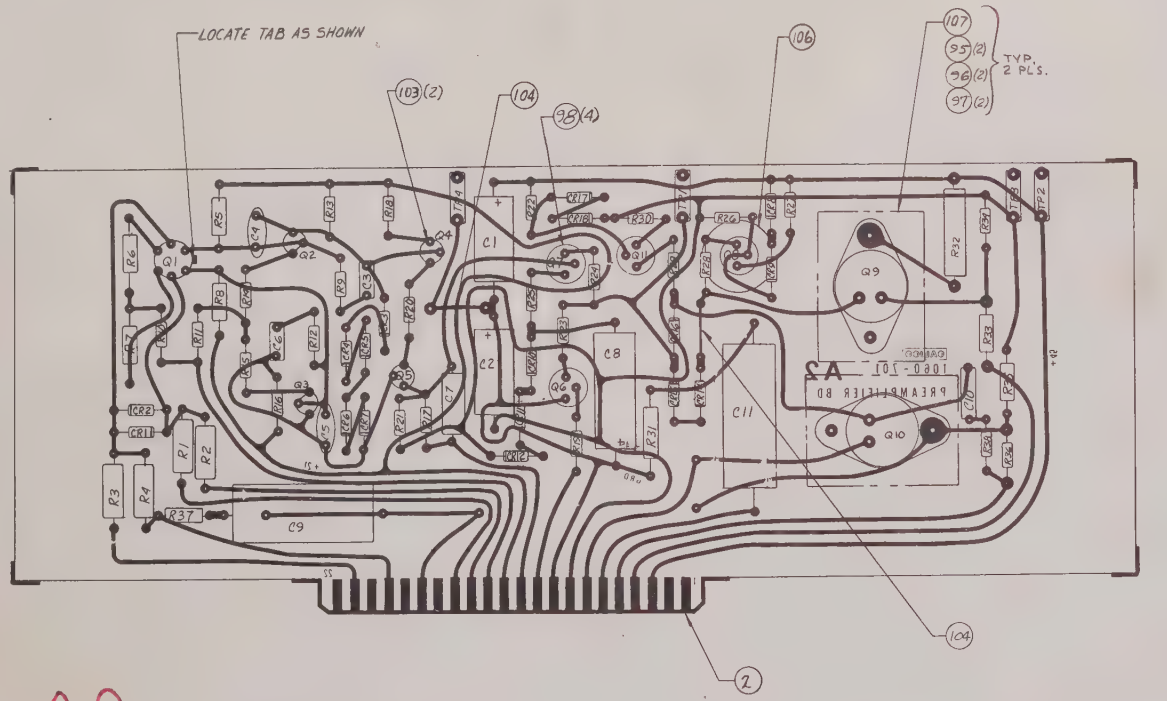
CHF ENGR

DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

D1360-700 D

A1


TP1
AMPLITUDE CORRECTION ERROR SIGNAL
LOW SIGNAL OUTPUT -.6 VDC
TP3 PHASE ERROR CORRECTION SIGNAL
TP6 GND
AMPLITUDE CONTROL MODULATOR
TUNED AMPLIFIER
RESONANT FREQ ADJ
LINE CORRECTOR DC OUTPUT ADJ.
60 Hz
20.3V P-P
-.6 VDC
TP2 REFERENCE OUTPUT
16 REFERENCE OUTPUT
+8 VDC WITH 1V P-P RIPPLE AT 120 Hz
DC REF PWR SUPPLY
OUTPUT VOLTAGE ADJUST
AC - DC CONVERTER
AMPLITUDE ERROR INTEGRATOR
-21 VDC
GND
TO SEC 3 OF POWER XFMR
6 GND
TP4 PHASE SERVO VOLTAGE
1 +21 VDC
TO SEC 2 OF POWER XFMR
GRD
PHASE CONTROL DEMODULATOR
PHASE ADJ
VOLTAGE CONTROLED PHASE SHIFT NETWORK
HEAT-SINK
PHASE ERROR INTEGRATOR
TO SEC. 1 OF POWER TRANSFORMER
A1
CALICO PART NO 1360-700
FOR MODEL 1310 & 1352, C10 & C14 ARE 1 µF.
ALL CAPACITANCE IS IN µF.
ALL RESISTORS ARE 1/4 W 5%
NOTES: UNLESS OTHERWISE SPECIFIED
SCHEMATIC DIAGRAM, REFERENCE BD ASSY.
CALICO
MODEL 1360
E1360-071 F
SCALE NONE



APPLIES TO:
R32
R33
R35
R36
R31

A2
BOARD
" PRE AMP "

A2
-1 ASSEMBLY
VIEW COMPONENT SIDE

2. ON ALL LARGE CAPACITORS BEND LEADS OVER BEFORE SOLDERING. (i.e.: C9 & C11)
1. FOR SCHEMATIC SEE DWG. NO. E1060-070.

NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE
-1		PL 1060-701	PARTS LIST	SHEETS 1, 5 & 6				

DIM IN INCHES TOLERANCES XXX — .010, XX — .03, X — 1/64. BREAK ALL SHARP CORNERS & EDGES MACH SURFACES. ✓

DWG SIZE D

TITLE: PREAMPLIFIER A2 P.C. BOARD ASSY

MODEL 1060

RELEASE

CHECKER J. ROORDA 2/10/72 PURCHASING

DES.GN PROJ ENGR

DRFTSMN Wiener 11/10/71 CHF ENGR

CALICO — CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

CONTRACT NO. | CODE IDENT 16067

DWG NO D1060-701 | REV E

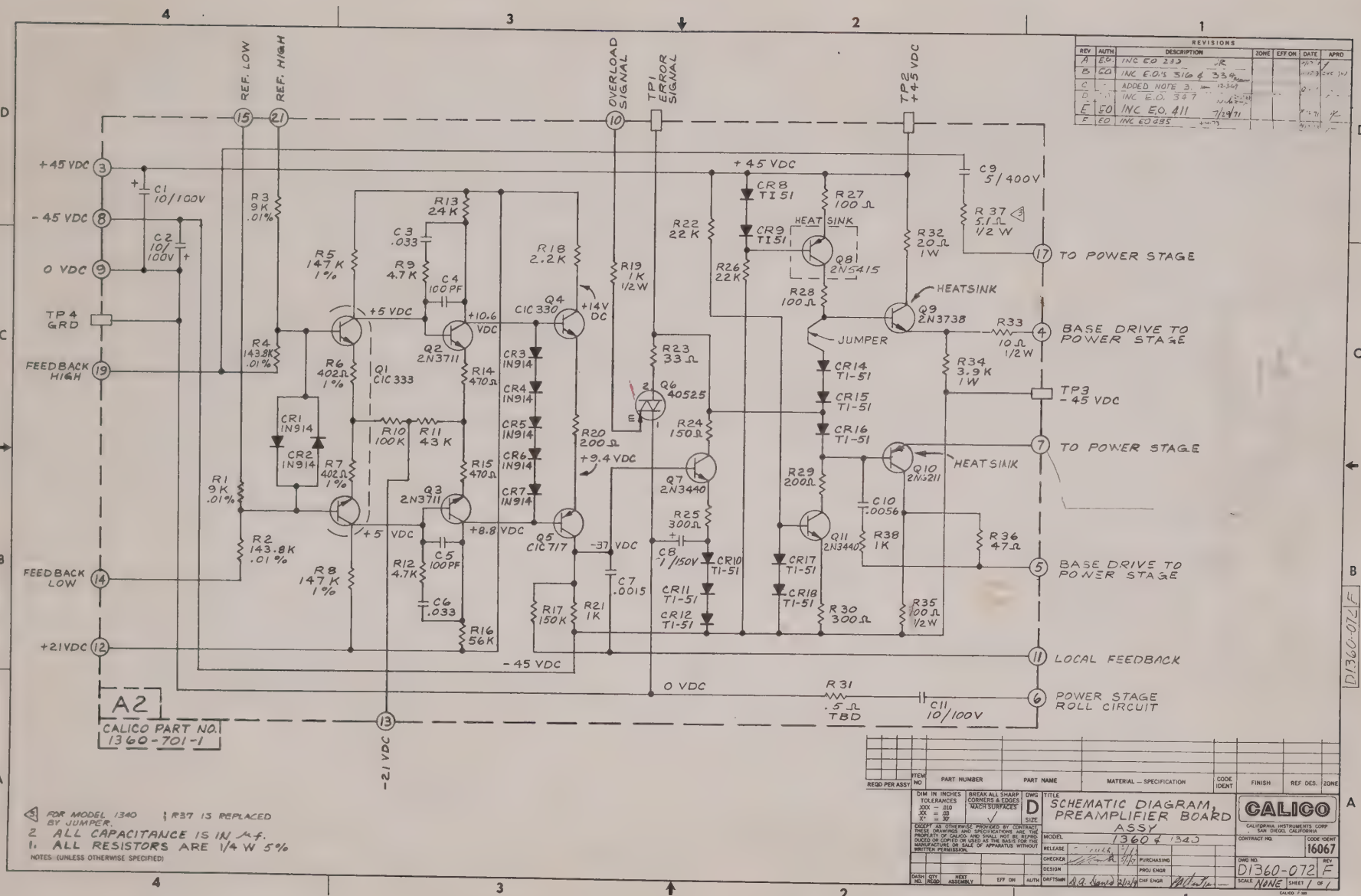
SCALE 2/1 | SHEET 2 OF 6

DASH NO | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION

D1060-701 E

A2



REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A	EO	INC EO 249				
B	EO	INC E.O.'s 316 & 334				
C		ADDED NOTE 3.				
D		INC E.O. 347				
E	EO	INC EO 411				
F	EO	INC EO 485				

1. ALL RESISTORS ARE 1/4 W 5%
2. ALL CAPACITANCE IS IN μf.
3. FOR MODEL 1340 R37 IS REPLACED BY JUMPER.

NOTES (UNLESS OTHERWISE SPECIFIED)

ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE

REQD PER ASSY

DIM IN INCHES TOLERANCES: XXX ± .010, XX ± .03, X ± .10
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓
DWG SIZE D

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO, AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: SCHEMATIC DIAGRAM, PREAMPLIFIER BOARD ASSY

CALICO — CALIFORNIA INSTRUMENTS CORP, SAN DIEGO, CALIFORNIA

MODEL 1360 & 1340 | CONTRACT NO. | CODE IDENT 16067

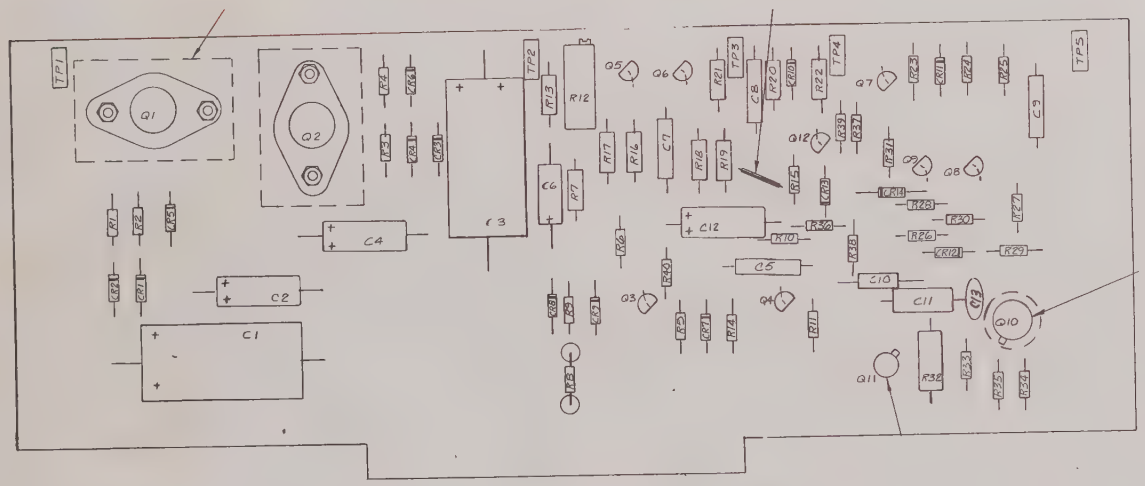
RELEASE | CHECKER | DESIGN | DRAFTSMAN D.A. Stanley 2/13/69 | PURCHASING | PROJ ENGR | CHF ENGR

DWG NO. D1360-072 | REV F | SCALE NONE | SHEET 1 OF 1

DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

D1360-072 F

A3 BOARD
"OVERLOAD"



AC Board

REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
		SEE SHEET 1.				

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY	ML 1360-702	PARTS LIST	SHEETS 4,5,&6				

DIM IN INCHES TOLERANCES XXX ± .010 XX ± .03 X ± .06 — BREAK ALL SHARP CORNERS & EDGES MACH SURFACES — DWG SIZE D

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: POWER SUPPLY & OVERLOAD P.C. BOARD ASSY A3

MODEL 1360

RELEASE

CHECKER

DESIGN

DRFTSMN 11-20-63

PURCHASING

PROJ ENGR

CHF ENGR

CALICO — CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

CONTRACT NO

CODE IDENT NO 16067

DWG NO D1360-702 REV E

SCALE 2 X SHEET 2 OF 6

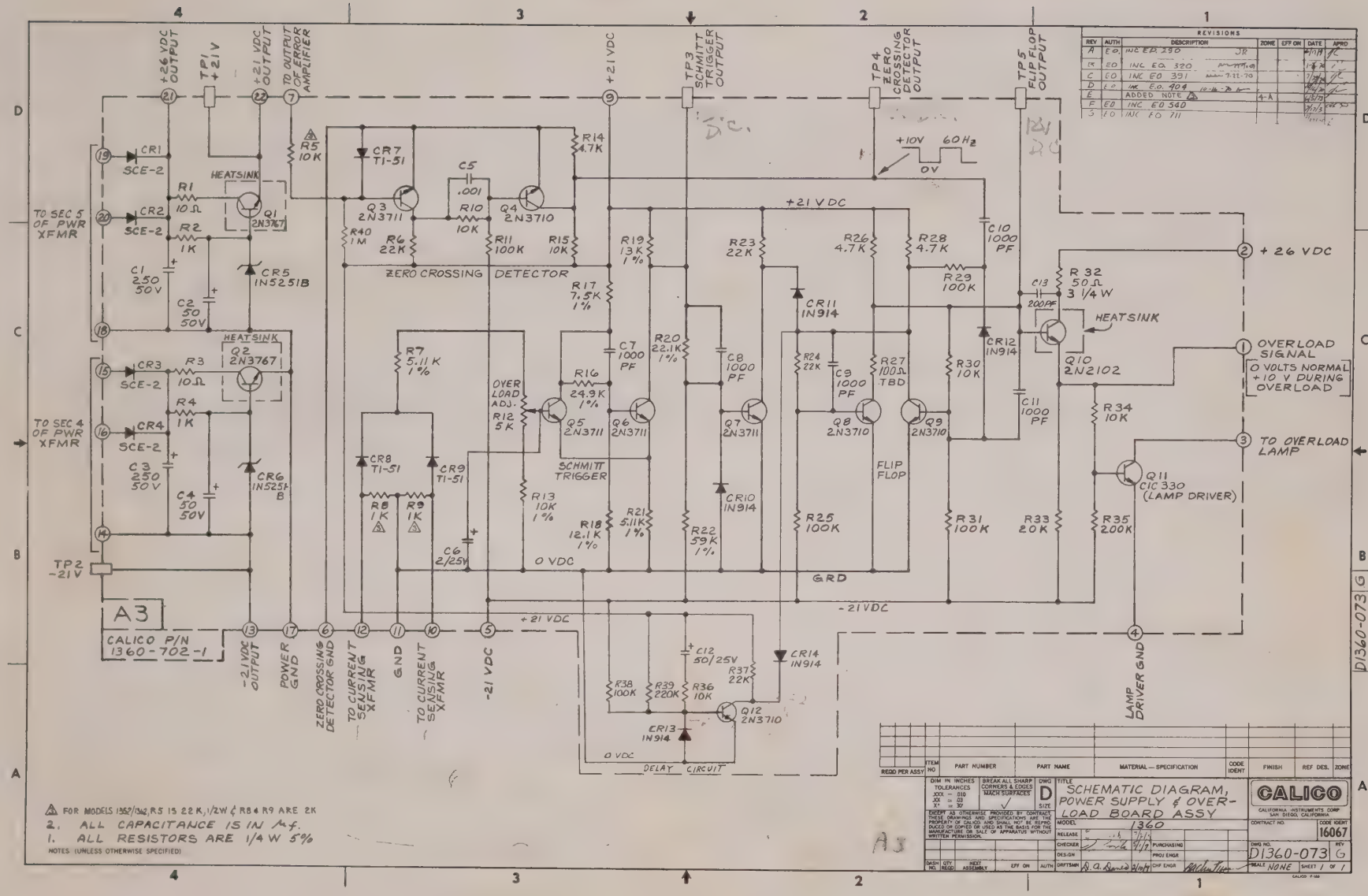
DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

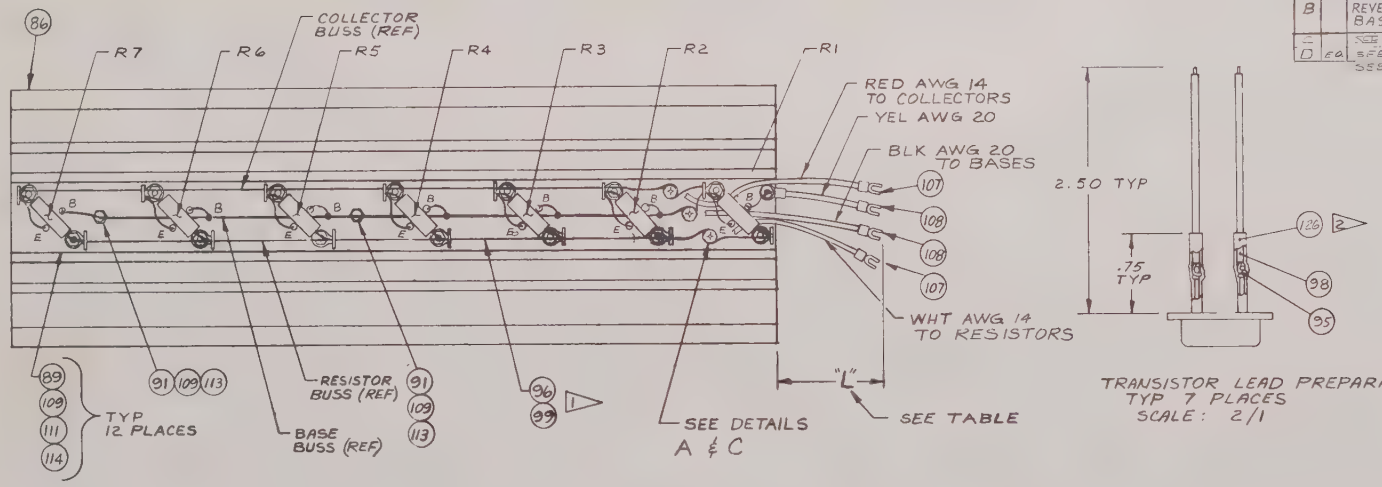
NOTES: (UNLESS OTHERWISE SPECIFIED)

2. ON ALL LARGE CAPACITORS, BEND LEADS OVER BEFORE SOLDERING (i.e. C1 & C2).
1. FOR SCHEMATIC DIAGRAM SEE DWG No. D1360-073.

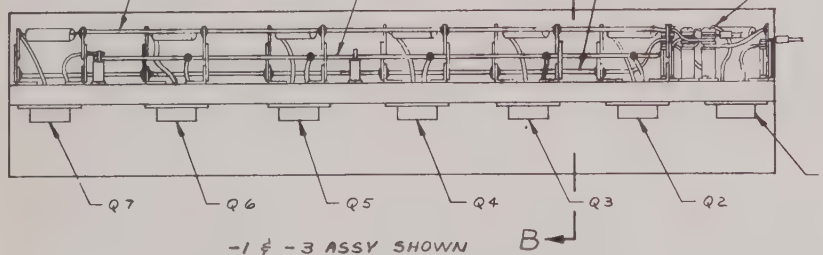
D1360-702 E

A3

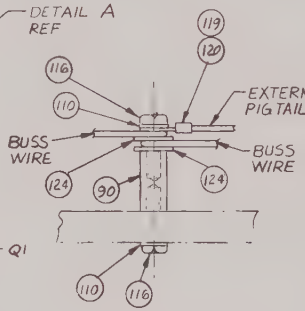

+26 VDC OUTPUT
TP1 +21V
+21 VDC OUTPUT
TO OUTPUT OF ERROR AMPLIFIER
+21 VDC
TP3 SCHMITT TRIGGER OUTPUT
TP4 ZERO CROSSING DETECTOR OUTPUT
TP5 FLIP FLOP OUTPUT
REVISIONS
REV AUTH DESCRIPTION ZONE EFF ON DATE APPD
A EO INC EO 290 JB
B EO INC EO 320
C EO INC EO 391
D EO INC EO 904
E ADDED NOTE 4-A
F EO INC EO 540
G EO INC EO 711
+10V 60Hz
0V
TO SEC 5 OF PWR XFMR
TO SEC 4 OF PWR XFMR
CR1 SCE-2
CR2 SCE-2
CR3 SCE-2
CR4 SCE-2
HEATSINK
Q1 2N3767
Q2 2N3767
R1 10Ω
R2 1K
R3 10Ω
R4 1K
C1 250 50V
C2 50 50V
C3 250 50V
C4 50 50V
CR5 IN5251B
CR6 IN5251B
TP2 -21V
A3
CALICO P/N 1360-702-1
-21 VDC OUTPUT
POWER GND
ZERO CROSSING DETECTOR GND
TO CURRENT SENSING XFMR
GND
TO CURRENT SENSING XFMR
-21 VDC
R5 10K
CR7 T1-51
C5 .001
Q3 2N3711
Q4 2N3710
R10 10K
R14 4.7K
R40 1M
R6 22K
R11 100K
R15 10K
ZERO CROSSING DETECTOR
R17 7.5K 1%
R19 13K 1%
R23 22K
R26 4.7K
R28 4.7K
R29 100K
C10 1000 PF
+21 VDC
CR11 IN914
R32 50Ω 3 1/4W
C13 200PF
HEATSINK
Q10 2N2102
CR12 IN914
+ 26 VDC
OVERLOAD SIGNAL
0 VOLTS NORMAL
+10 V DURING OVERLOAD
R7 5.11K 1%
R16 24.9K 1%
C7 1000 PF
R20 22.1K 1%
C8 1000 PF
R24 22K
C9 1000 PF
R27 100Ω TBD
R30 10K
C11 1000 PF
R34 10K
TO OVERLOAD LAMP
OVER LOAD ADJ. R12 5K
Q5 2N3711
Q6 2N3711
Q7 2N3711
Q8 2N3710
Q9 2N3710
SCHMITT TRIGGER
FLIP FLOP
Q11 CIC 330 (LAMP DRIVER)
CR8 T1-51
CR9 T1-51
R8 1K
R9 1K
R13 10K 1%
R18 12.1K 1%
R21 5.11K 1%
R22 59K 1%
CR10 IN914
R25 100K
R31 100K
R33 20K
R35 200K
C6 2/25V
0 VDC
GRD
-21VDC
+21 VDC
C12 50/25V
CR14 IN914
R37 22K
R38 100K
R39 220K
R36 10K
Q12 2N3710
CR13 IN914
0 VDC
DELAY CIRCUIT
LAMP DRIVER GND
FOR MODELS 1357/362, R5 IS 22K, 1/2W & R84 R9 ARE 2K
2. ALL CAPACITANCE IS IN Mf.
1. ALL RESISTORS ARE 1/4 W 5%
NOTES (UNLESS OTHERWISE SPECIFIED)
REQD PER ASSY
ITEM NO
PART NUMBER
PART NAME
MATERIAL — SPECIFICATION
CODE IDENT
FINISH
REF DES.
ZONE
DIM IN INCHES TOLERANCES XXX — .010 XX — .03 X — ± 30
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES
DWG SIZE D
TITLE SCHEMATIC DIAGRAM, POWER SUPPLY & OVER-LOAD BOARD ASSY
MODEL 1360
CALICO
CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA
CONTRACT NO.
CODE IDENT 16067
DWG NO. D1360-073
REV G
SCALE NONE
SHEET 1 OF 1
RELEASE
CHECKER
DESIGN
DRAFTSMAN
PURCHASING
PROJ ENGR
CHF ENGR
AUTH
EFF ON
NEXT ASSEMBLY
DASH NO.
QTY REQD
D1360-073 G



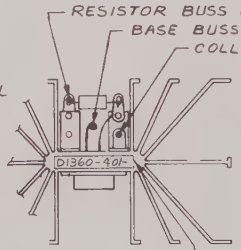
TRANSISTOR LEAD PREPARATION
TYP 7 PLACES
SCALE: 2/1



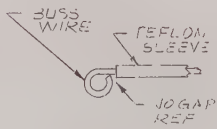
-1 & -3 ASSY SHOWN



DETAIL A
TYP 4 PLACES
SCALE: NONE



SECTION B-B



DETAIL C
TYP 7 PLACES
SCALE: NONE

32 FOR -1
84 FOR -3

LOCATE ON EXTERNAL WIRE END OF HEATSINK

"L"	
WIRE	LENGTH (MIN)
AWG 20 BLACK	5 1/4 INCHES
AWG 20 YELLOW	4 1/2 INCHES
AWG 14 WHITE	4 1/2 INCHES
AWG 14 RED	4 INCHES

3. FOR SCHEMATIC SEE DRAWING NO. D1360-074

2 SHRINKING TO BE DONE AFTER INSTALLATION OF TRANSISTORS.

1 ALL BUSS WIRE TO BE 14 AWG, COVERED WITH TEFLON SLEEVING.

NOTES (UNLESS OTHERWISE SPECIFIED)

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
B		REVERSE EMITTER & BASE LOCATIONS.				
-		SEE SHEET 1				
D	EA	SEE SHEET 1.				

REQD PER ASSY | ITEM NO | PART NUMBER | PART NAME | MATERIAL — SPECIFICATION | CODE IDENT | FINISH | REF DES | ZONE

DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 30' | BREAK ALL SHARP CORNERS & EDGES MACH SURFACES √

DWG SIZE D

TITLE: POWER HEATSINK ASSY, 3KVA LINE CORRECTOR

MODEL 1360

RELEASE

CHECKER

DESIGN

DRAFTSMAN

PURCHASING

PROJ ENGR

CHF ENGR

CALICO — CALIFORNIA INSTRUMENTS CORP SAN DIEGO CALIFORNIA

CONTRACT NO | CODE IDENT 16067

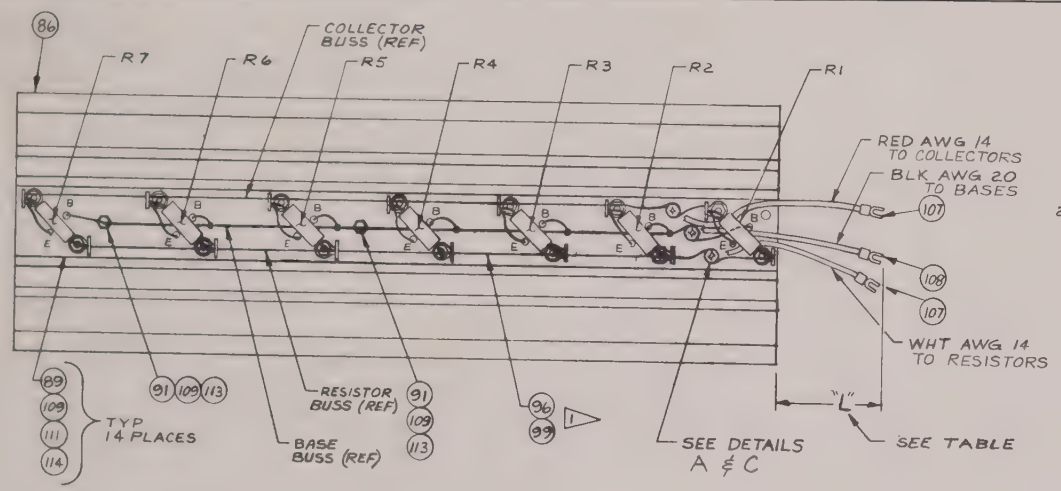
DWG NO D1360-401 | REV E

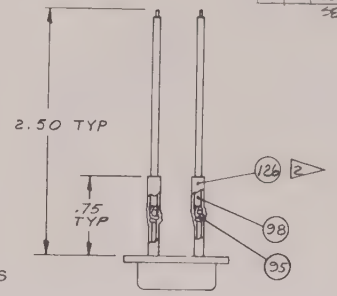
SCALE 1/1 | SHEET 2 OF 7

DASH NO | QTY PER QQ | NEXT ASSEMBLY | EFF ON | AUTH

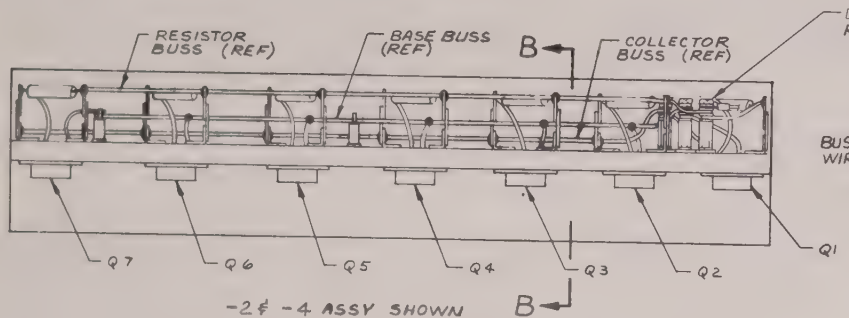
EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

D1360-401 E

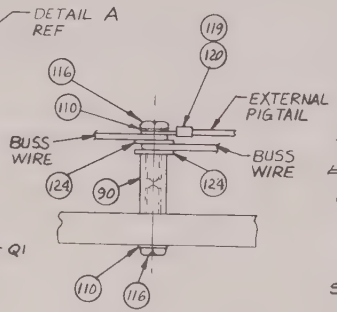




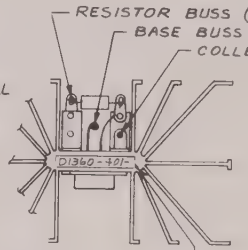
TRANSISTOR LEAD PREPARATION
TYP 7 PLACES
SCALE: 2/1



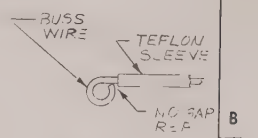
-2 & -4 ASSY SHOWN



DETAIL A
TYP 3 PLACES
SCALE: NONE



SECTION B-B



DETAIL C
TYP 6 PLACES
SCALE: NONE

(33) =OR -2
(35) =OR -4
LOCATE ON EXTERNAL WIRE END OF HEATSINK.

"L"	
WIRE	LENGTH (MIN.)
AWG 20 BLACK	4 INCHES
AWG 14 WHITE	4 3/4 INCHES
AWG 14 RED	5 1/4 INCHES

200 thousand dianeth of hole for
transit pass

3. FOR SCHEMATIC SEE DRAWING NO. D1360-074
2 SHRINKING TO BE DONE AFTER INSTALLATION OF TRANSISTORS.
1 ALL BUSS WIRE TO BE 14 AWG, COVERED WITH TEFLON SLEEVING.
NOTES (UNLESS OTHERWISE SPECIFIED)

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APPD
B		REVERSED EMITTER & BASE LOCATIONS.				
C		SEE SHEET 1				
D		SEE SHEET 1				

SEE SHEET 1

REQD PER ASSY

ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES	ZONE

DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 1°
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES
DWG SIZE D

TITLE: POWER HEATSINK ASSY, 3KVA LINE CORRECTOR

CALICO — CALIFORNIA INSTRUMENT'S CORP SAN DIEGO, CALIFORNIA

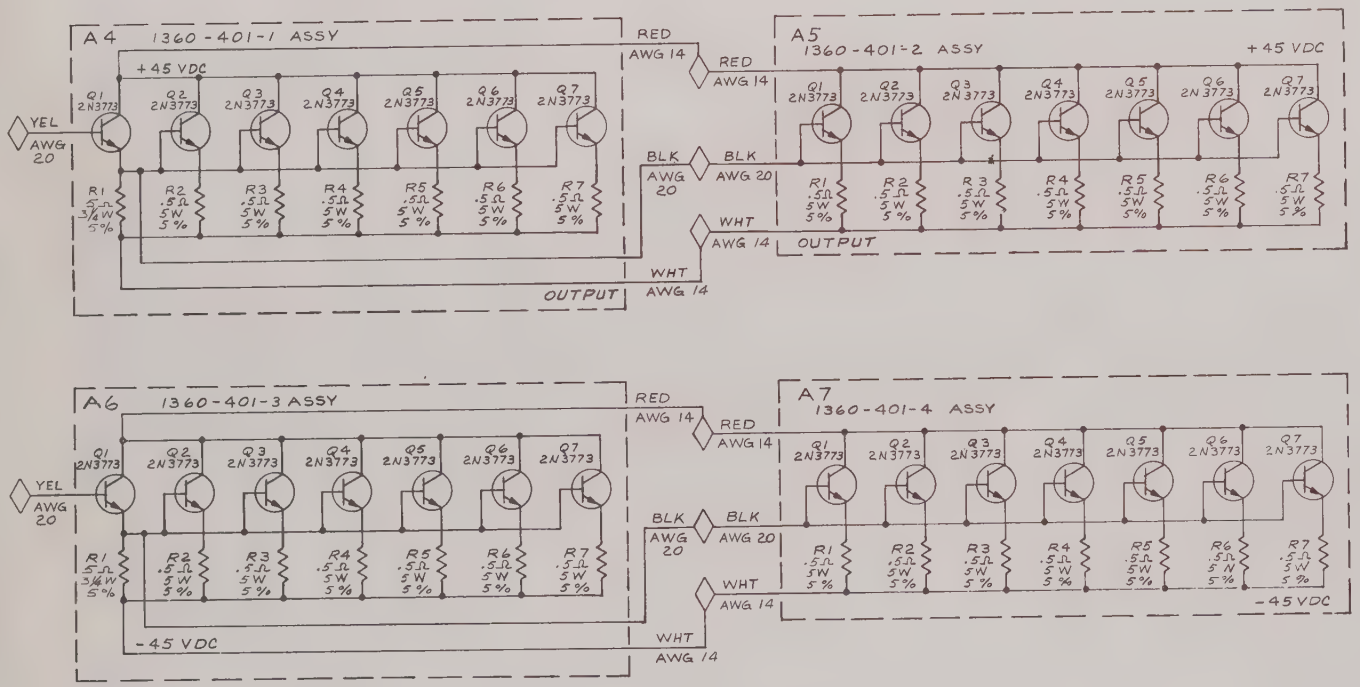
EXCEPT AS OTHERWISE PROVIDED BY CONTRACT THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

MODEL 1360
CONTRACT NO
CODE IDENT 16067
RELEASE
CHECKER
DESIGN
DRFTSMN
PURCHASING
MFG ENGR
CHF ENGR
DWG NO D1360-401
REV E
SCALE 1/1
SHEET 3 of 7

DASH NO | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

D1360-401 E

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A	E.O.	INC. EO's 316 & 334				



1. THE SYMBOL ◇ INDICATES TERMINAL BOARD CONNECTION ON TOP ASSY.

NOTES: (UNLESS OTHERWISE SPECIFIED)

ITEM NO	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE	REQD PER ASSY

DIM IN INCHES TOLERANCES: XXX = .010, XX = .03, X° = 30'. BREAK ALL SHARP CORNERS & EDGES MACH SURFACES.

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THIS DRAWING AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DWG SIZE D

TITLE: SCHEMATIC DIAGRAM POWER HEATSINK ASSY

MODEL 1360

RELEASE

CHECKER

DESIGN

PURCHASING

PROJ ENGR

CHF ENGR

DRFT'SMN D. A. Davis

CALICO

CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. D1360-074 REV A

SCALE NONE SHEET 1 OF 1

DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

D1360-074 A

REPLACEABLE PARTS

8.1 GENERAL

This section contains ordering information and complete list of replaceable parts. Parts are listed by major assembly in alphanumeric order of their reference designators. Description, manufacturers part number, manufacturers code ident number (see Appendix A for list of manufacturers), and California Instruments stock numbers are indicated.

8.2 ORDERING INFORMATION

In order to provide our customers with prompt service on replacement parts, please provide the following information, when applicable, for each part ordered:

a) Model number and serial number of the instrument,

b) California Instruments part number of the sub-assembly where component is located,

c) Component reference designator,

d) Component description,

e) Component manufacturer number and code ident,

f) California Instruments stock number.

All replacement parts orders should be placed with CALIFORNIA INSTRUMENTS COMPANY, a division of Aiken Industries, San Diego, California 92111.

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	E1360-400-1	TOP ASSEMBLY, 3KVA	16067		1
					2
					3
	B1060-214-7	PLATE	16067	1-30151	4
					5
	E1360-200-1	CHASSIS ASSY	16067	1-30168	6
	E1360-201-7	FRONT PANEL	16067	1-30169	7
	E1360-202-1	REAR PANEL ASSY	16067	1-30170	8
	D1360-203-1	ENCLOSURE ASSY	16067	1-30171	9
	D1360-204-7	CHASSIS COVER	16067	1-30172	10
	D1360-205-7	HEATSINK COVER	16067	1-30173	11
	D1360-205-8	HEATSINK COVER	16067	1-30174	12
	C1360-206-1	P.C. COVER ASSY	16067	1-30175	13
					14
	B1360-209-7	RETAINER	16067	1-30178	15
	B1360-210-7	INSULATOR	16067	1-30179	16
	B1360-210-8	INSULATOR	16067	1-30180	17
	C1360-211-7	DIODE HEATSINK	16067	1-30181	18
					19
	D1360-213-7	TRANSFORMER SUPPORT	16067	1-30183	20
	C1360-216-7	TRANSFORMER SUPPORT	16067	1-30184	21
	C1360-217-7	SPACER, POWER RESISTOR	16067	1-10115	22
	C1360-217- 8	SPACER, POWER RESISTOR	16067	1-10116	23
					24
A1	1360-700-1	BOARD ASSY	16067		25
A2	1360-701-1	BOARD ASSY	16067		26
A3	1360-702-1	BOARD ASSY	16067		27
A4	D1360-401-1	POWER HEATSINK ASSY	16067		28
A5	D1360-401-2	POWER HEATSINK ASSY	16067		29
A6	D1360-401-3	POWER HEATSINK ASSY	16067		30
A7	D1360-401-4	POWER HEATSINK ASSY	16067		31
					32
					33
B1	WS2107F	FAN	23936	2-41063	34
B2	WS2107F	FAN	23936	2-41063	35
B3	WS2107F	FAN	23936	2-41063	36

MODEL 1360 — CALICO P/N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 4 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP., SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
C1	625B1C106M*	CAPACITOR 10μF 200V	14752	6-10856	37
	*TESTED TO 75V RMS at 60Hz				38
C2	36D153F075CF6A	CAPACITOR 15000/75	56289	6-10528	39
C3	36D153F075CF6A	CAPACITOR 15000/75	56289	6-10528	40
C4	36D153F075CF6A	CAPACITOR 15000/75	56289	6-10528	41
C5	36D153F075CF6A	CAPACITOR 15000/75	56289	6-10528	42
					43
					44
CB1	AM12-50 -250-5-60	CIRCUIT BREAKER 50A	74193	2-40319	45
					46
					47
					48
CR1	IN 1186A	DIODE RECTIFIER	86684	3-10167	49
CR2	IN 1186A	DIODE RECTIFIER	86684	3-10167	50
CR3	IN 1186A	DIODE RECTIFIER	86684	3-10167	51
CR4	IN 1186A	DIODE RECTIFIER	86684	3-10167	52
					53
					54
					55
DS1	NE 51 H (B1A)	LAMP, NEON	03797	2-41107	56
DS2	1819	LAMP, INCADESCANT	03797	2-41028	57
					58
					59
					60
J1	3430	OUTLET (30A)	74545	2-41110	61
J2	5362	OUTLET (20A)	74545	2-41111	62
J3	5362	OUTLET (20A)	74545	2-41111	63
					64
					65
					66
M1	50-167141NLNL	AMPMETER 0-30	03508	2-41103	67
M2	50-167031PZPZ1	VOLTMETER 0-150	03508	2-41069	68
					69
					70
					71
					72

MODEL 1360 — CALICO P/N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 5 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
P1	8BD22S	CONNECTOR	81312	4-10083	73
P2	8BD22S	CONNECTOR	81312	4-10083	74
P3	8BD22S	CONNECTOR	81312	4-10083	75
					76
					77
					78
Q1	CIC 303	TRIAC	86684	3-30169	79
Q2	CIC 303	TRIAC	86684	3-30169	80
					81
					82
					83
R1	RH-10-10 · 033Ω ±5%	RESISTOR .033Ω 10W	91637	5-50119	84
R2	RH-10-10 · 033Ω ±5%	RESISTOR .033Ω 10W	91637	5-50119	85
R3	RH-25-22 · 033Ω ±5%	RESISTOR .033Ω 25W	91637	5-50120	86
R4	RC32GF181J	RESISTOR 180Ω 1W 5%	81349	5-30069	87
R5	RC32GF181J	RESISTOR 180Ω 1W 5%	81349	5-30069	88
					89
					90
					91
S1	412-3	TAP SWITCH	44655	2-40320	92
S2	7565K5	TOGGLE SWITCH	88026	2-40266	93
					94
					95
					96
T1	1360-010-1	TRANSFORMER	16067	7-10123	97
T2	1360-011-1	TRANSFORMER	16067	7-10124	98
T3	1360-012-1	TRANSFORMER	16067	7-10125	99
T4	TY-61X	TRANSFORMER	81095	7-10165	100
					101
TB7	3005	TERMINAL STRIP	71785	2-40111	102
TB1	9-85-3	TERMINAL BLOCK	75382	2-40321	103
TB2	602C-5	TERMINAL BOARD	75382	2-40322	104
TB3	602C-5	TERMINAL BOARD	75382	2-40322	105
TB4	850	TERMINAL STRIP	83330	2-50079	106
TB5		NOT USED			107
TB6	863	TERMINAL STRIP	83330	2-50052	108

MODEL 1360 — CALICO P/N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 6 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
XDS1	TAG-6022-TA160AC	LAMP HOLDER	03797	2-41113	109
XDS2	TAF-6020-TA160RC	LAMP HOLDER	03797	2-50040	110
					111
					112
					113
	PS95PL-2	KNOB (BLACK)	21604	2-40237	114
	550481	GUARD	82877	2-41064	115
	FCA-4	HANDLE	08730	2-40225	116
	58-30-40	BOARD GUIDE	07556	2-41074	117
	1012K11700	BEZEL	03516	2-40060	118
	CMC-40	BRACKET	56289	2-41105	119
	5/16-18 x 7/8 Long	ELEVATOR BOLT	70318	2-41114	120
	2151	GROMMET, 5/16 Mounting	08065	2-10088	121
	52-1502	TERMINAL	83330	2-50080	122
	2187	GROMMET	83330	2-10089	123
					124
	836	CABLE CLAMP	83330		125
	837	CABLE CLAMP	83330		126
					127
	656	CRIMP LUG, RING TYPE	79963	2-50081	128
	C8020-632	TINNERMAN	78553	2-10091	129
	1/4" MOLDED	SHOULDER WASHER, NYLON	23050	2-10322	130
	3431	OUTLET, PLUG	74545	4-10144	131
					132
					133
	16-22	CRIMP LUG		120-4	134
	14-16	CRIMP LUG		120-4	135
	10-14	CRIMP LUG, RING TYPE		120-4	136
					137
					138
					139
	#2 X 1/4 Type B	SCREW, SELF TAPPING, Rd. Hd.	18702	2-10092	140
	#2-56 X 1/2	SCREW, PAN HEAD		2-10592	141
					142
					143
	#4-40 X 3/8	SCREW, PAN HEAD		120-4	144

MODEL 1360 — CALICO P N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 7 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	#4-40 X 5/8	SCREW, PAN HEAD		120-4	145
	4-40 x 3/8	SCREW, FLAT HEAD 100°		120-4	146
					147
	#6-32 X 3/16 Long	SCREW, PAN HEAD		120-4	148
	#6-32 X 5/16 Long	SCREW, PAN HEAD		120-4	149
	#6-32 X 3/8 Long	SCREW, PAN HEAD		120-4	150
	#6-32 X 3/8 Long	SCREW, FLAT HEAD 100°		120-4	151
	#6-32 X 1/2 Long	SCREW, PAN HEAD		120-4	152
	#6-32 X 1/2 Long	SCREW, FLAT HEAD 100°		120-4	153
	#6-32 X 5/8 Long	SCREW, PAN HEAD		120-4	154
	#6-32 X 1 1/2 Long	SCREW, PAN HEAD		2-10094	155
	#6-32 X 1/4 Long	SCREW, PAN HEAD			156
	#6-32 X 7/8 Long	SCREW, PAN HEAD			157
					158
	#8-32 X 3/8 Long	SCREW, PAN HEAD		120-4	159
	#8-32 X 1/2 Long	SCREW, FLAT HEAD 100°		120-4	160
	#8-32 X 1 Long	SCREW, PAN HEAD		120-4	161
					162
					163
					164
	#10-32 X 3/8 Long	SCREW, PAN HEAD		120-4	165
	#10-32 X 3/8 Long	SCREW, HEX HEAD	81349	2-10354	166
	#10-32 x 1/2 Long	SCREW, HEX HEAD	81349	2-10274	167
					168
	#4	WASHER, FLAT		120-4	169
	#6	WASHER, FLAT		120-4	170
	#8	WASHER, FLAT		120-4	171
	NAS620 5/16	WASHER, FLAT		2-10095	172
	NAS620 3/8	WASHER, FLAT		2-10096	173
	NAS620 1/4	WASHER, FLAT		2-10097	174
					175
					176
					177
	#2	WASHER, SPLIT LOCK		2-10101	178
	#4	WASHER, INT. LOCK		120-4	179
	#6	WASHER, SPLIT LOCK		120-4	180

MODEL 1360 — CALICO P/N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 8 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	#8	WASHER, SPLIT LOCK		120-4	181
	#10	WASHER, SPLIT LOCK		120-4	182
	5/16	WASHER, SPLIT LOCK		2-10098	183
					184
					185
					186
	#2-56	NUT, HEX		2-10099	187
	#4-40	NUT, HEX		120-4	188
	#6-32	NUT, HEX		120-4	189
	#8-32	NUT, HEX		120-4	190
	5/16-18	NUT, HEX		2-10107	191
	#10-32	NUT, HEX			192
					193
					194
	5/16-18 x 3 1/2 Long	BOLT, MACHINE, Rd. Head		2-10100	195
					196
					197
					198
	847	INDUSTRIAL ADHESIVE	04963		199
	1/2 X 1 X 2 7/8	SPONGE RUBBER		120-4	200
					201
					202
					203
	AWG 20	TEFLON SLEEVING		120-4	204
					205
					206
					207
	PRODUCT #128	WEATHERSTRIP	79130	120-4	208

MODEL 1360 — CALICO P/N 1360-400 — ASSY R.O.

TITLE TOP ASSEMBLY, 3KVA LINE CORRECTOR — SHT 9 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1	1360-700-1	Reference P. C. Board Assy	16067		1
	-7	P. C. Board	16067	1-55061	2
	(See Sheet 3)	Eyelet			3
	B1060-213-7	Bracket	16067	1-30146	4
A1C1	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	5
A1C2	TE 1209	Capacitor 50 μf 25V	56289	6-10368	6
A1C3	210B1B104M	Capacitor . 1 μf 50V	14752	6-10727	7
A1C4	TE 1102	Capacitor 100 μf 6V	56289	6-10375	8
A1C5	TE 1087	Capacitor 10 μf 6V	56289	6-10415	9
A1C6	Z5U-.001	Capacitor . 001 μf 1 KV	72982	6-10062	10
A1C7	Z5U-.001	Capacitor . 001 μf 1 KV	72982	6-10062	11
A1C8	TE 1209	Capacitor 50 μf 25V	56289	6-10368	12
A1C9	1DP-1-223K	Capacitor . 022 μf 10%	04062	6-10531	13
A1C10	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	14
A1C11	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	15
A1C12	TE 1133	Capacitor 50 μf 12V	56289	6-10363	16
A1C13	TE 1307	Capacitor 50 μf 50V	56289	6-10371	17
A1C14	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	18
A1C15	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	19
A1C16	625B1B106M	Capacitor 10 μf 100V	14752	6-10854	20
A1C17	625B1B106M	Capacitor 10 μf 100V	14752	6-10854	21
A1C18	CM06F511J03	Capacitor 510 pf	JEDEC	6-10046	22
A1C19	CM05F391J03	Capacitor 390 pf	JEDEC	6-10289	23
A1C20	CM05F391J03	Capacitor 390 pf	JEDEC	6-10289	24
A1C21	1DP-1-223K	Capacitor . 022 μf 10%	04062	6-10531	25
A1C22	Z1A155	Capacitor 1. 5 μf 100V	12406	6-10855	26
A1C23	Z1A155	Capacitor 1. 5 μf 100V	12406	6-10855	27
A1C24	TE 1204	Capacitor 10 μf 25V	56289	6-10338	28
A1C25	CM06F471J03	Capacitor 470 pf	JEDEC	6-10291	29
A1C26	CM06F471J03	Capacitor 470 pf	JEDEC	6-10291	30
A1C27	1DP-1-223K	Capacitor . 022 μf 10%	04062	6-10531	31
A1C28	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	32
A1C29	112A1B105M	Capacitor 1 μf 100V	14752	6-10721	33
A1C30	1DP-3-154K	Capacitor . 15 μf 10%	04062	6-10478	34
					35
					36

MODEL	CALICO P N	ASSY R.O.
1360	1360-700	
TITLE: Reference Printed Circuit Board Assembly	SHT 4 OF 9	A1

CALICO | CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA | CODE IDENT 16067 | PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					37
					38
					39
A1CR1	1N 914	Diode	JEDEC	3-10118	40
A1CR2	1N 914	Diode	JEDEC	3-10118	41
A1CR3	1N 914	Diode	JEDEC	3-10118	42
A1CR4	CIC 702-7	Diode	16067	3-10189	43
A1CR5	1N 5234A	Diode	JEDEC	3-10130	44
A1CR6	SCE 2	Diode	14099	3-10079	45
A1CR7	SCE 2	Diode	14099	3-10079	46
A1CR8	1N 914	Diode	JEDEC	3-10118	47
A1CR9	1N 5231A	Diode	JEDEC	3-10143	48
A1CR10	1N 914	Diode	JEDEC	3-10118	49
A1CR11	1N 914	Diode	JEDEC	3-10118	50
A1CR12	1N 5231A	Diode	JEDEC	3-10143	51
					52
					53
					54
					55
					56
A1Q1	CIC 330	Transistor	16067	3-30008	57
A1Q2	2N 3710	Transistor	01295	3-30096	58
A1Q3	CIC 330	Transistor	16067	3-30008	59
A1Q4	CIC 330	Transistor	16067	3-30008	60
A1Q5	CIC 333	Transistor	16067	3-30012	61
A1Q6	2N 3710	Transistor	01295	3-30096	62
A1Q7	2N 3710	Transistor	01295	3-30096	63
A1Q8	CIC 330	Transistor	16067	3-30008	64
A1Q9	CIC 718	Transistor	16067	3-30041	65
A1Q10	CIC 330	Transistor	16067	3-30008	66
A1Q11	CIC 330	Transistor	16067	3-30008	67
A1Q12	CIC 330	Transistor	16067	3-30008	68
A1Q13	CIC 333	Transistor	16067	3-30012	69
A1Q14	2N 3638	Transistor	02335	3-30094	70
A1Q15	CIC 718	Transistor	16067	3-30041	71
A1Q16	CIC 336	Transistor	16067	3-30015	72

MODEL	1360	CALICO P/N	1360-700	ASSY R.O.
TITLE	Reference Printed Circuit Board Assembly	SHT 5	OF 9	A1

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067 — **PARTS LIST**

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1Q17	2N 3711	Transistor	01295	3-30098	73
A1Q18	2N 3711	Transistor	01295	3-30098	74
A1Q19	CIC 330	Transistor	16067	3-30008	75
A1Q20	CIC 718	Transistor	16067	3-30041	76
A1Q21	1060-012	Transistor, Dual	16067	3-30170	77
A1Q22	2N 3710	Transistor	01295	3-30096	78
A1Q23	2N 3710	Transistor	01295	3-30096	79
A1Q24	2N 3710	Transistor	01295	3-30096	80
A1Q25	2N 3710	Transistor	01295	3-30096	81
A1Q26	CIC 330	Transistor	16067	3-30008	82
A1Q27	CIC 718	Transistor	16067	3-30041	83
A1Q28	2N 2102	Transistor	95303	3-30075	84
A1Q29	CIC 330	Transistor	16067	3-30008	85
					86
					87
					88
					89
					90
A1R1	3068P-1-504	Variable Resistor 500 K	80294	5-70055	91
A1R2	RC07GF J	Resistor t.b.d. 5% 1/4W	JEDEC		92
A1R3	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	93
A1R4	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	94
A1R5	RC07GF242J	Resistor 2.4K 5% 1/4W	JEDEC	5-10061	95
A1R6	RC07GF242J	Resistor 2.4K 5% 1/4W	JEDEC	5-10061	96
A1R7	RC07GF682J	Resistor 6.8K 5% 1/4W	JEDEC	5-10072	97
A1R8	78PR2K	Variable Resistor 2K	73138	5-70020	98
A1R9	3300A-014-61	Resistor 13.9K ,1%	16067	5-80140	99
A1R10	RC07GF154J	Resistor 150K 5% 1/4W	JEDEC	5-10104	100
A1R11	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	101
A1R12	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	102
A1R13	RC07GF154J	Resistor 150K 5% 1/4W	JEDEC	5-10104	103
A1R14	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	104
A1R15	RC07GF273J	Resistor 27K 5% 1/4W	JEDEC	5-10086	105
A1R16	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	106
A1R17	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	107
A1R18	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	108

MODEL 1360 — CALICO P N 1360-700 — ASSY R.O. A1

TITLE Reference Printed Circuit Board Assembly — SHT 6 OF 9

CALICO | CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA | CODE IDENT 16067 | PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R19	RC07GF333J	Resistor 33K 5% 1/4W	JEDEC	5-10088	109
A1R20	RN60D4991F	Resistor 4.99K 1%	JEDEC	5-60051	110
A1R21	RN60D2002F	Resistor 20K 1%	JEDEC	5-60098	111
A1R22	RC07GF473J	Resistor 47K 5% 1/4W	JEDEC	5-10092	112
A1R23	RC07GF202J	Resistor 2K 5% 1/4W	JEDEC	5-10059	113
A1R24	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	114
A1R25	RC07GF202J	Resistor 2K 5% 1/4W	JEDEC	5-10059	115
A1R26	RC07GF391J	Resistor 390Ω 5% 1/4W	JEDEC	5-10043	116
A1R27	3300A-014-51	Resistor 10K .1%	16067	5-80096	117
A1R28	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	118
A1R29	3300A-014-51	Resistor 10K .1%	16067	5-80096	119
A1R30	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	120
A1R31	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	121
A1R32	RC07GF473J	Resistor 47K 5% 1/4W	JEDEC	5-10092	122
A1R33	RC07GF202J	Resistor 2K 5% 1/4W	JEDEC	5-10059	123
A1R34	RN60C7150F	Resistor 715Ω 1%	JEDEC	5-60419	124
A1R35	RC07GF133J	Resistor 13K 5% 1/4W	JEDEC	5-10079	125
A1R36	RN60D1471F	Resistor 1.47K 1%	JEDEC	5-60025	126
A1R37	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	127
A1R38	RN60D1471F	Resistor 1.47K 1%	JEDEC	5-60025	128
A1R39	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	129
A1R40	RN60D1003F	Resistor 100K 1%	JEDEC	5-60131	130
A1R41	RN60D1003F	Resistor 100K 1%	JEDEC	5-60131	131
A1R42	RN60D3323F	Resistor 332K 1%	JEDEC	5-60156	132
A1R43	3068P-1-504	Variable Resistor 500K	80294	5-70055	133
A1R44	RC07GF202J	Resistor 2K 5% 1/4W	JEDEC	5-10059	134
A1R45	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	135
A1R46	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	136
A1R47	RC07GF221J	Resistor 220Ω 5% 1/4W	JEDEC	5-10037	137
A1R48	RN70D1504F	Resistor 1.5M 1%	JEDEC	5-60180	138
A1R49	RN60D2611F	Resistor 2.61K 1%	JEDEC	5-60036	139
A1R50	RN60D2611F	Resistor 2.61K 1%	JEDEC	5-60036	140
A1R51	RN70D1504F	Resistor 1.5M 1%	JEDEC	5-60180	141
A1R52	RN65D1504F	Resistor 1.5M 1%	JEDEC	5-60181	142
A1R53	RC07GF124J	Resistor 120K 5% 1/4W	JEDEC	5-10102	143
A1R54	RC07GF473J	Resistor 47K 5% 1/4W	JEDEC	5-10092	144

MODEL 1360 | CALICO P/N 1360-700 | ASSY R.O. A1

TITLE Reference Printed Circuit Board Assembly | SHT 7 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP., SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R55	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	145
A1R56	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	146
A1R57	RC07GF823J	Resistor 82K 5% 1/4W	JEDEC	5-10098	147
A1R58	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	148
A1R59	RC07GF202J	Resistor 2K 5% 1/4W	JEDEC	5-10059	149
A1R60	RC07GF331J	Resistor 330Ω 5% 1/4W	JEDEC	5-10041	150
A1R61	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	151
A1R62	RC07GF512J	Resistor 5.1K 5% 1/4W	JEDEC	5-10069	152
A1R63	RC07GF512J	Resistor 5.1K 5% 1/4W	JEDEC	5-10069	153
A1R64	RC07GF242J	Resistor 2.4K 5% 1/4W	JEDEC	5-10061	154
A1R65	RC07GF242J	Resistor 2.4K 5% 1/4W	JEDEC	5-10061	155
A1R66	RC07GF242J	Resistor 2.4K 5% 1/4W	JEDEC	5-10061	156
A1R67	3067P-1-102	Variable Resistor 1K	80294	5-70015	157
A1R68	RC07GF273J	Resistor 27K 5% 1/4W	JEDEC	5-10086	158
A1R69	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	159
A1R70	RC07GF153J	Resistor 15K 5% 1/4W	JEDEC	5-10080	160
A1R71	RC07GF154J	Resistor 150K 5% 1/4W	JEDEC	5-10104	161
A1R72	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	162
A1R73	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	163
A1R74	RC07GF154J	Resistor 150K 5% 1/4W	JEDEC	5-10104	164
A1R75	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	165
A1R76	RC07GF273J	Resistor 27K 5% 1/4W	JEDEC	5-10086	166
A1R77	RC07GF163J	Resistor 16K 5% 1/4W	JEDEC	5-10081	167
A1R78	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	168
A1R79	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	169
A1R80	RC07GF303J	Resistor 30K 5% 1/4W	JEDEC	5-10087	170
A1R81	RC07GF511J	Resistor 510Ω 5% 1/4W	JEDEC	5-10046	171
A1R82	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	172
A1R83	RC07GF331J	Resistor 330Ω 5% 1/4W	JEDEC	5-10041	173
A1R84	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	174
A1R85	RC07GF272J	Resistor 2.7K 5% 1/4W	JEDEC	5-10062	175
A1R86	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	176
A1R87	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	177
A1R88	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	178
A1R89	RC07GF392J	Resistor 3.9K 5% 1/4W	JEDEC	5-10066	179
A1R90	RC07GF272J	Resistor 2.7K 5% 1/4W	JEDEC	5-10062	180

MODEL 1360 — CALICO P N 1360-700 — ASSY R.O. A1

TITLE Reference Printed Circuit Board Assembly — SHT 8 OF 9

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R91	RC07GF822J	Resistor 8.2K 5% 1/4W	JEDEC	5-10074	181
					182
					183
					184
					185
A1L1	HVC-8	Variable Inductor	89665	5-90045	186
A1L2	HVC-9	Variable Inductor	89665	5-90046	187
					188
					189
					190
					191
					192
A1TP1	430-108	Test Jack (Brown)	83330	2-41089	193
A1TP2	430-102	Test Jack (Red)	83330	2-41085	194
A1TP3	430-106	Test Jack (Orange)	83330	2-41086	195
A1TP4	430-107	Test Jack (Yellow)	83330	2-41087	196
					197
A1TP6	430-105	Test Jack (Blue)	83330	2-41091	198
					199
					200
					201
A1VR1	B1060-402-1	Photo Resistor Assy	16067		202
	RCT018110-1A	Transipads	19080	2-40297	203
	RCT05075-7A	Transipads	19080	2-40296	204
	NF207	Heatsink	05820	2-41050	205
	#4-40, 3/16 Long	Screw, Pan Hd		120-4	206
	#4	Washer, Int. Star		120-4	207
	#4-40	Nut		120-4	208
	22 AWG	Wire		120-4	209
		Sleeving for 22 AWG			210

MODEL	CALICO P/N	ASSY R.O.
1360	1360-700	
TITLE: Reference Printed Circuit Board Assembly	SHT 9 OF 9	A1

CALICO — CALIFORNIA INSTRUMENTS CORP., SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2	1360-701-1	Pre-amp. P.C. Bd Assy	16067		1
	-7	P.C. Board	16067	1-55062	2
A2C1	TE 1407	Capacitor 10 µf 100V	56289	6-10197	3
A2C2	TE 1407	Capacitor 10 µf 100V	56289	6-10197	4
A2C3	1DP-1-333K	Capacitor .033 µf 100V	04062	6-10512	5
A2C4	CM05F101K03	Capacitor 100 pf 500V	JEDEC	6-10027	6
A2C5	CM05F101K03	Capacitor 100 pf 500V	JEDEC	6-10027	7
A2C6	1DP-1-333K	Capacitor .033 µf 100V	04062	6-10512	8
A2C7	ZD1A152	Capacitor .0015 µf 100V	12406	6-10540	9
A2C8	TE 1500	Capacitor 1µf 150V	56289	6-10758	10
A2C9	ZD4A505	Capacitor 5 µf 400V	12406	6-10541	11
A2C10	Z5U	Capacitor .0056 µf	71590	6-10081	12
A2C11	625B1B106M	Capacitor 10µf 100V	14752	6-10854	13
					14
					15
					16
					17
A2CR1	1N 914	Diode	JEDEC	3-10118	18
A2CR2	1N 914	Diode	JEDEC	3-10118	19
A2CR3	1N 914	Diode	JEDEC	3-10118	20
A2CR4	1N 914	Diode	JEDEC	3-10118	21
A2CR5	1N 914	Diode	JEDEC	3-10118	22
A2CR6	1N 914	Diode	JEDEC	3-10118	23
A2CR7	1N 914	Diode	JEDEC	3-10118	24
A2CR8	TI-51	Diode	01295	3-10090	25
A2CR9	TI-51	Diode	01295	3-10090	26
A2CR10	TI-51	Diode	01295	3-10090	27
A2CR11	TI-51	Diode	01295	3-10090	28
A2CR12	TI-51	Diode	01295	3-10090	29
A2CR13		Not Used			30
A2CR14	TI-51	Diode	01295	3-10090	31
A2CR15	TI-51	Diode	01295	3-10090	32
A2CR16	TI-51	Diode	01295	3-10090	33
A2CR17	TI-51	Diode	01295	3-10090	34
A2CR18	TI-51	Diode	01295	3-10090	35
					36

MODEL 1360 | CALICO P/N 1360-701 E | ASSY R.O. A2

TITLE Preamplifier P.C. Board Assembly | SHT 4 OF 6

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					37
					38
					39
					40
A2Q1	CIC 333	Transistor	16067	3-30012	41
A2Q2	2N 3711	Transistor	01295	3-30098	42
A2Q3	2N 3711	Transistor	01295	3-30098	43
A2Q4	CIC 330	Transistor	16067	3-30008	44
A2Q5	CIC 717	Transistor	16067	3-30120	45
A2Q6	40525	Transistor	95303	3-30122	46
A2Q7	2N 3440	Transistor	95303	3-30090	47
A2Q8	2N 5415	Transistor	95303	3-30141	48
A2Q9	2N 3738	Transistor	04713	3-30100	49
A2Q10	2N6211 (2N3741)	Transistor	95303	3-30183	50
A2Q11	2N 3440	Transistor	95303	3-30090	51
					52
					53
					54
					55
					56
A2R1	EP-21	Resistor 9K .01%	07088	5-80018	57
A2R2	EP-21	Resistor 143.8K .01%	07088	5-80060	58
A2R3	EP-21	Resistor 9K .01%	07088	5-80018	59
A2R4	EP-21	Resistor 143.8K .01%	07088	5-80060	60
A2R5	RN60D1473F	Resistor 147K 1%	JEDEC	5-60142	61
A2R6	RN60D4020F	Resistor 402Ω 1%	JEDEC	5-60010	62
A2R7	RN60D4020F	Resistor 402Ω 1%	JEDEC	5-60010	63
A2R8	RN60D1473F	Resistor 147K 1%	JEDEC	5-60142	64
A2R9	RC07GF472J	Resistor 4.7K 5% 1/4W	JEDEC	5-10068	65
A2R10	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	66
A2R11	RC07GF433J	Resistor 43K 5% 1/4W	JEDEC	5-10091	67
A2R12	RC07GF472J	Resistor 4.7K 5% 1/4W	JEDEC	5-10068	68
A2R13	RC07GF243J	Resistor 24K 5% 1/4W	JEDEC	5-10085	69
A2R14	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	70
A2R15	RC07GF471J	Resistor 470Ω 5% 1/4W	JEDEC	5-10045	71
A2R16	RC07GF563J	Resistor 56K 5% 1/4W	JEDEC	5-10094	72

MODEL 1360 — CALICO P/N 1360-701 F — ASSY R.O. A2

TITLE Pre-amplifier P.C. Board Assembly — SHT 5 OF 6

CALICO — CALIFORNIA INSTRUMENTS CORP., SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2R17	RC07GF154J	Resistor 150K 5% 1/4W	JEDEC	5-10104	73
A2R18	RC07GF222J	Resistor 2.2K 5% 1/4W	JEDEC	5-10060	74
A2R19	RC20GF102J	Resistor 1K 5% 1/2W	JEDEC	5-20034	75
A2R20	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	76
A2R21	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	77
A2R22	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	78
A2R23	RC07GF330J	Resistor 33Ω 5% 1/4W	JEDEC	5-10017	79
A2R24	RC07GF151J	Resistor 150Ω 5% 1/4W	JEDEC	5-10033	80
A2R25	RC07GF301J	Resistor 300Ω 5% 1/4W	JEDEC	5-10040	81
A2R26	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	82
A2R27	RC07GF101J	Resistor 100Ω 5% 1/4W	JEDEC	5-10029	83
A2R28	RC07GF101J	Resistor 100Ω 5% 1/4W	JEDEC	5-10029	84
A2R29	RC07GF201J	Resistor 200Ω 5% 1/4W	JEDEC	5-10036	85
A2R30	RC07GF301J	Resistor 300Ω 5% 1/4W	JEDEC	5-10040	86
A2R31	RS-2B	Resistor .5Ω 3% 3W	91637	5-50010	87
A2R32	RC32GF200J	Resistor 20Ω 5% 1W	JEDEC	5-30012	88
A2R33	RC20GF100J	Resistor 10Ω 5% 1/2W	JEDEC	5-20006	89
A2R34	RC32GF392J	Resistor 3.9K 5% 1W	JEDEC	5-30076	90
A2R35	RC20GF101J	Resistor 100Ω 5% 1/2W	JEDEC	5-20018	91
A2R36	RC07GF470J	Resistor 47Ω 5% 1/4W	JEDEC	5-10021	92
A2R37	RC20GF51.1J	Resistor 5.1Ω 5% 1/2W	JEDEC	5-20125	93
A2R38	RC07GF102J	Resistor 1K 1/4W 5%	JEDEC	5-10053	94
	4-40x5/16 Lg.	Screw, Round Head			95
	4-40	Nut, Hex			96
	#4	Washer, Int. Star			97
	RCT05075-7A	Transipad	19080	2-40296	98
A2TP1	430-108	Test Jack (Brown)	83330	2-41089	99
A2TP2	430-102	Test Jack (Red)	83330	2-41085	100
A2TP3	430-106	Test Jack (Orange)	83330	2-41086	101
A2TP4	430-107	Test Jack (Yellow)	83330	2-41087	102
	RCT018110-1A	Transipads	19080	2-40297	103
	22 AWG	Wire		120-4	104
		Eyelets (See Sheets 3)			105
	TXBX-032-025B	Heatsink	98978	2-40120	106
	LB66B1B	Heatsink	98978	2-41047	107
	#22	Teflon Tubing			108

MODEL 1360 — CALICO P/N 1360-701 — E — ASSY R.O. A2

TITLE Pre-amplifier P.C. Board Assembly — SHT 6 OF 6

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3	1360-702-1	Power Supply Board Assy	16067		1
	-7	P. C. Board	16067	1-55063	2
	(See Sheet 3)	Eyelet			3
A3C1	BR250-50	Capacitor 250 µf 50V	14655	6-10395	4
A3C2	TE 1307	Capacitor 50 µf 50V	56289	6-10371	5
A3C3	BR250-50	Capacitor 250 µf 50V	14655	6-10395	6
A3C4	TE 1307	Capacitor 50 µf 50V	56289	6-10371	7
A3C5	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	8
A3C6	TE 1201	Capacitor 2 µf25V	56289	6-10325	9
A3C7	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	10
A3C8	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	11
A3C9	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	12
A3C10	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	13
A3C11	WMF 1D1	Capacitor . 001 µf 100V	14655	6-10060	14
A3C12	TE 1209	Capacitor 50 µf 25V	56289	6-10368	15
A3C13	CM05FD201J03	Capacitor 200pf 500V	81349	6-10282	16
					17
					18
A3CR1	SCE 2	Diode	14099	3-10079	19
A3CR2	SCE 2	Diode	14099	3-10079	20
A3CR3	SCE 2	Diode	14099	3-10079	21
A3CR4	SCE 2	Diode	14099	3-10079	22
A3CR5	1N 5251B	Diode, Zener	JEDEC	3-10131	23
A3CR6	1N 5251B	Diode, Zener	JEDEC	3-10131	24
A3CR7	T1-51	Diode	01295	3-10090	25
A3CR8	T1-51	Diode	01295	3-10090	26
A3CR9	T1-51	Diode	01295	3-10090	27
A3CR10	1N 914	Diode	JEDEC	3-10118	28
A3CR11	1N 914	Diode	JEDEC	3-10118	29
A3CR12	1N 914	Diode	JEDEC	3-10118	30
A3CR13	1N 914	Diode	JEDEC	3-10118	31
A3CR14	1N 914	Diode	JEDEC	3-10118	32
					33
					34
					35
A3Q1	2N 3767	Transistor	04713	3-30103	36

MODEL	CALICO P/N	ASSY R.O.
1360	1360-702	
TITLE: Power Supply and Overload P. C. Board Assembly	SHT 4 OF 6	A3

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3Q2	2N 3767	Transistor	04713	3-30103	37
A3Q3	2N 3711	Transistor	01295	3-30098	38
A3Q4	2N 3710	Transistor	01295	3-30096	39
A3Q5	2N 3711	Transistor	01295	3-30098	40
A3Q6	2N 3711	Transistor	01295	3-30098	41
A3Q7	2N 3711	Transistor	01295	3-30098	42
A3Q8	2N 3710	Transistor	01295	3-30096	43
A3Q9	2N 3710	Transistor	01295	3-30096	44
A3Q10	2N 2102	Transistor	95303	3-30075	45
A3Q11	CIC 330	Transistor	16067	3-30008	46
A3Q12	2N 3710	Transistor	01295	3-30096	47
					48
					49
					50
					51
A3R1	RC07GF100J	Resistor 10Ω 5% 1/4W	JEDEC	5-10005	52
A3R2	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	53
A3R3	RC07GF100J	Resistor 10Ω 5% 1/4W	JEDEC	5-10005	54
A3R4	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	55
A3R5	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	56
A3R6	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	57
A3R7	RN60D5111F	Resistor 5.11K 1%	JEDEC	5-60055	58
A3R8	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	59
A3R9	RC07GF102J	Resistor 1K 5% 1/4W	JEDEC	5-10053	60
A3R10	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	61
A3R11	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	62
A3R12	3067P-1-502	Variable Resistor 5K	80294	5-70029	63
A3R13	RN60D1002F	Resistor 10K 1%	JEDEC	5-60079	64
A3R14	RC07GF472F	Resistor 4.7K5% 1/4W	JEDEC	5-10068	65
A3R15	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	66
A3R16	RN60D2492F	Resistor 24.9K 1%	JEDEC	5-60105	67
A3R17	RN60D7501F	Resistor 7.5K 1%	JEDEC	5-60067	68
A3R18	RN60D1212F	Resistor 12.1K 1%	JEDEC	5-60086	69
A3R19	RN60D1302F	Resistor 13K 1%	JEDEC	5-60090	70
A3R20	RN60D2212F	Resistor 22.1K 1%	JEDEC	5-60103	71
A3R21	RN60D5111F	Resistor 5.11K 1%	JEDEC	5-60055	72

MODEL 1360 — CALICO P/N 1360-702 — ASSY R.O. A3

TITLE Power Supply and Overload P. C. Board Assembly — SHT 5 OF 6

CALICO — CALIFORNIA INSTRUMENTS CORP., SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3R22	RN60D5902F	Resistor 59K 1%	JEDEC	5-60120	73
A3R23	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	74
A3R24	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	75
A3R25	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	76
A3R26	RC07GF472J	Resistor 4.7K 5% 1/4W	JEDEC	5-10068	77
A3R27	RC07GF101J	Resistor 100Ω 5% 1/4W	JEDEC	5-10029	78
A3R28	RC07GF472J	Resistor 4.7K 5% 1/4W	JEDEC	5-10068	79
A3R29	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	80
A3R30	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	81
A3R31	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	82
A3R32	4380	Resistor 50Ω 3 1/4W	44655	5-50022	83
A3R33	RC07GF203J	Resistor 20K 5% 1/4W	JEDEC	5-10083	84
A3R34	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	85
A3R35	RC07GF204J	Resistor 200K 5% 1/4W	JEDEC	5-10107	86
A3R36	RC07GF103J	Resistor 10K 5% 1/4W	JEDEC	5-10076	87
A3R37	RC07GF223J	Resistor 22K 5% 1/4W	JEDEC	5-10084	88
A3R38	RC07GF104J	Resistor 100K 5% 1/4W	JEDEC	5-10100	89
A3R39	RC07GF224J	Resistor 220K 5% 1/4W	JEDEC	5-10108	90
A3R40	RC07GF105J	Resistor 1M 5% 1/4W	JEDEC	5-10123	91
A3TP1	430-108	Test Jack (Brown)	83330	2-41089	92
A3TP2	430-102	Test Jack (Red)	83330	2-41085	93
A3TP3	430-106	Test Jack (Orange)	83330	2-41086	94
A3TP4	430-107	Test Jack (Yellow)	83330	2-41087	95
A3TP5	430-104	Test Jack (Green)	83330	2-41090	96
					97
	RCT05075-7A	Transipads	19080	2-40296	98
	RCT018110-1A	Transipads	19080	2-40297	99
					100
					101
	LB66B1B	Heatsink	98978	2-41047	102
	4-40 x 5/16 Long	Screw, Round Head		120-4	103
	4-40	Nut, Hex		120-4	104
	#4	Washer, Int. Star		120-4	105
	#22	Buss Wire			106
	NF 207	Heatsink	05820	2-41050	107
	#22	Teflon Sleeving			108

MODEL 1360 — CALICO P N 1360-702 — ASSY R.O. A3

TITLE Power Supply and Overload P. C. Board Assembly — SHT 6 OF 6

CALICO	CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
		POWER HEATSINK ASSEMBLY 3 KVA			1
					2
A4	D1360-401-1	HEATSINK ASSEMBLY	16067		3
A5	D1360-401-2	HEATSINK ASSEMBLY	16067		4
A6	D1360-401-3	HEATSINK ASSEMBLY	16067		5
A7	D1360-401-4	HEATSINK ASSEMBLY	16067		6
					7
					8
A4Q1	2N 3773	TRANSISTOR	95303	3-30140	9
A4Q2	2N 3773	TRANSISTOR	95303	3-30140	10
A4Q3	2N 3773	TRANSISTOR	95303	3-30140	11
A4Q4	2N 3773	TRANSISTOR	95303	3-30140	12
A4Q5	2N 3773	TRANSISTOR	95303	3-30140	13
A4Q6	2N 3773	TRANSISTOR	95303	3-30140	14
A4Q7	2N 3773	TRANSISTOR	95303	3-30140	15
					16
					17
					18
A4R1	4349	RESISTOR 5 Ω 3 1/4W	44655	5-50007	19
A4R2	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	20
A4R3	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	21
A4R4	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	22
A4R5	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	23
A4R6	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	24
A4R7	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	25
					26
					27
					28
A5Q1	2N 3773	TRANSISTOR	95303	3-30140	29
A5Q2	2N 3773	TRANSISTOR	95303	3-30140	30
A5Q3	2N 3773	TRANSISTOR	95303	3-30140	31
A5Q4	2N 3773	TRANSISTOR	95303	3-30140	32
A5Q5	2N 3773	TRANSISTOR	95303	3-30140	33
A5Q6	2N 3773	TRANSISTOR	95303	3-30140	34
A5Q7	2N 3773	TRANSISTOR	95303	3-30140	35
					36

MODEL 1360	CALICO P/N 1360-401	ASSY R.O.
TITLE POWER HEATSINK ASSEMBLY, 3 KVA	SHT 4 OF 7	

CALICO	CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A5R1	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	37
A5R2	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	38
A5R3	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	39
A5R4	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	40
A5R5	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	41
A5R6	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	42
A5R7	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	43
					44
					45
					46
A6Q1	2N 3773	TRANSISTOR	95303	3-30140	47
A6Q2	2N 3773	TRANSISTOR	95303	3-30140	48
A6Q3	2N 3773	TRANSISTOR	95303	3-30140	49
A6Q4	2N 3773	TRANSISTOR	95303	3-30140	50
A6Q5	2N 3773	TRANSISTOR	95303	3-30140	51
A6Q6	2N 3773	TRANSISTOR	95303	3-30140	52
A6Q7	2N 3773	TRANSISTOR	95303	3-30140	53
					54
					55
					56
A6R1	4349	RESISTOR 5Ω 3 1/4W	44655	5-50007	57
A6R2	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	58
A6R3	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	59
A6R4	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	60
A6R5	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	61
A6R6	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	62
A6R7	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	63
					64
					65
A7Q1	2N 3773	TRANSISTOR	95303	3-30140	66
A7Q2	2N 3773	TRANSISTOR	95303	3-30140	67
A7Q3	2N 3773	TRANSISTOR	95303	3-30140	68
A7Q4	2N 3773	TRANSISTOR	95303	3-30140	69
A7Q5	2N 3773	TRANSISTOR	95303	3-30140	70
A7Q6	2N 3773	TRANSISTOR	95303	3-30140	71
A7Q7	2N 3773	TRANSISTOR	95303	3-30140	72

MODEL 1360	CALICO P/N 1360-401	ASSY R.O.
TITLE POWER HEATSINK ASSEMBLY, 3 KVA	SHT 5 OF 7	

CALICO — CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA — CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A7R1	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	73
A7R2	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	74
A7R3	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	75
A7R4	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	76
A7R5	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	77
A7R6	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	78
A7R7	RW55GR50WL	RESISTOR .5Ω 5W 10%	63743	5-50141	79
	*To be purchased under part number C1360-214-7.				80
	C1360-214-7	DECAL	16067	1-30166	81
	C1360-214-1*	DECAL	16067		82
	C1360-214-2*	DECAL	16067		83
	C1360-214-3*	DECAL	16067		84
	C1360-214-4*	DECAL	16067		85
	D1360-215-7	HEATSINK	16067	1-30167	86
					87
					88
	849	TERMINAL STRIP	83330	2-50083	89
	4050-221-7	SPACER, THREADED	16067	1-60036	90
	1601-A	TERMINAL	88245	2-40317	91
					92
	THERMATE	SILICONE COMPOUND			93
					94
	20 AWG	WIRE, BUSS			95
	14 AWG	WIRE, BUSS			96
					97
	20 AWG	SLEEVING, TEFLON			98
	14 AWG	SLEEVING, TEFLON			99
					100
	14 AWG	WIRE, (COLOR RED)			101
	14 AWG	WIRE, (COLOR WHITE)			102
	20 AWG	WIRE, (COLOR BLACK)			103
	20 AWG	WIRE, (COLOR YELLOW)			104
					105
					106
	16-14	SPADE LUG		120-4	107
	18-22	SPADE LUG		120-4	108

MODEL 1360 — CALICO P/N 1360-401 — ASSY R.O.

TITLE POWER HEATSINK ASSEMBLY, 3 KVA — SHT 6 OF 7

CALICO | CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA | CODE IDENT 16067 | **PARTS LIST**

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	#6	WASHER, EXTERNAL LOCK		120-4	109
	#8	WASHER, EXTERNAL LOCK		120-4	110
	6-32	NUT, HEX		120-4	111
					112
	6-32 x 1/2 Long	SCREW, PAN HEAD		120-4	113
	6-32 x 5/8 Long	SCREW, PAN HEAD		120-4	114
					115
	8-32 x 1/2 Long	SCREW, PAN HEAD			116
					117
					118
	14-16	CRIMP LUG, RING TYPE		120-4	119
	18-22	CRIMP LUG, RING TYPE		120-4	120
					121
					122
					123
	NAS620-8	WASHER, FLAT		2-10114	124
					125
		SHRINK TUBING		120-4	126

MODEL	1360	CALICO P/N	1360-401	ASSY R.O.
TITLE	POWER HEATSINK ASSEMBLY, 3KVA	SHT	7 OF 7	

APPENDIX A

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbook.

0000A	ElectriCord	Westfield	PA
000AA	OK Machine and Tool Corp.	New York	NY
000AB	Falmat	Harbor City	CA
0000B	Tech. Prod. Sales	Sorrento Valley	CA
0000C	Jackson Bros.	Waddon, Surrey	GB
0000D	Chicago Std. Transformer Co.	Chicago	IL
0000E	Use Code #08289		
0000F	Colvern	Santa Monica	CA
0000G	Use Code #30983		
0000H	Mial of Italy c/o Q.C. Components	Los Angeles	CA
0000I	Use Code #50522		
0000J	Use Code #34333		
0000K	Elma	Schweiz	GE
0000L	Use Code #32293		
0000M	Use Code #16950		
0000N	Use Code #15912		
0000P	Mesa Office Supply	San Diego	CA
0000R	American Handle	Philadelphia	PA
0000S	OPCDA	Edison	NJ
0000T	Use Code #31743		
0000U	Use Code #32293		
0000V	Falmat	Los Angeles	CA
0000W	Milltron Ross Co.	Southampton	PA
0000X	Use Code #52072		
0000Y	Use Code #29990		
0000Z	Timco	Los Angeles	CA
00141	Pic Design Corp.	E. Rockaway	NY
00194	Walsco Electronics Corporation	Los Angeles	CA
00544	Metal-Cal Div., Avery Prod. Corp.	Inglewood	CA
00656	Aerovox Corporation	New Bedford	MA
00779	AMP, Inc.	Harrisburg	PA
00853	Sangamo Electric Company	Pickens	SC
00866	Goe Eng. Co., Inc.	City of Industry	CA
01121	Allen-Bradley Company	Milwaukee	WI
01179	Ajax Magnethermic Corp.	NE Warren	OH
01255	Litton Industries, Inc.	Beverly Hills	CA
01281	T R W Semiconductors, Inc.	Lawndale	CA
*01295	Texas Instruments, Inc.	Dallas	TX
02111	Spectrol Electronics	City of Industry	CA
02114	Ferroxcube Corp.	Saugerties	NY
02335	Fairchild Controls Corp.	Hicksville, LI	NY
02660	Amphenol Corporation	Broadview	IL
02799	Use Code #72136		
03507	General Electric Company	Syracuse	NY
03508	General Electric Company	Syracuse	NY
03516	General Electric Company	Somersworth	NH
03797	Eldema Corporation	Compton	CA
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls	NJ
03911	Clairex Corporation	New York	NY
04009	Arrow-Hart and Hegeman Elec. Co.	Hartford	CT
04062	Use Code #72136		
04713	Motorola Semiconductor Prod., Inc.	Phoenix	AZ
04963	3-M	St. Paul	MN
05236	Jonathan Mfg. Co.	Fullerton	CA
05276	Pomona Electronics Co., Inc.	Pomona	CA
05347	Ultronix	Grand Junction	CO
05397	Kemet, Union Carbide Corp.	Cleveland	OH
05820	Wakefield Engineering, Inc.	Wakefield	MA
06046	Dixson Meter	Grand Junction	CO
06184	Conelco Components	San Bernadino	CA
06223	Kooltronic Fan Company	Princeton	NJ
06229	Electrovert, Incorporated	Mt. Vernon	NY
06383	Panduit Corp.	Tinley Park	IL
06514	Stantron, Wyco Metal Products	N. Hollywood	CA
06540	Amathom Elect. Hardward	New Rochelle	NY
06682	Magnetic Shield Div.	Chicago	IL
06776	Robinson, Nugent, Inc.	New Albany	IN
06915	Richco Plastics, Co.	Chicago	IL
07088	Kelvin Electric Company	Van Nuys	CA
07115	Use Code #14674		
07256	Silicon Transistor Corp.	Garden City	NY
07263	Fairchild Camera and Instr. Corp.	Mt. View	CA
07387	Birtcher Corporation	Los Angeles	CA
07556	Unitrack Calabro Plastics	Upper Darby	PA
07633	Epoxy Prod. Co. Div. of Allied Prod. Corp.	New Haven	CT
07713	Sperry Rand Corporation	Norwalk	CT
07716	I R C Incorporated	Burrington	IA
07910	Continental Devices	Hawthorne	CA
08065	Accurate Rubber and Plastics Co.	San Diego	CA
08261	Spectra Strip	Garden Grove	CA
08289	Blinn-Delbert Co., Inc.	Pomona	CA
08594	Eimac Div. of Varian Associates	Salt Lake	UT
08718	Use Code #71468		
08730	Vemaline Products Co.	Franklin Lakes	NJ
09026	Babcock Electronics Corp.	Costa Mesa	CA
09145	Atohm, Technical Industries, Inc.	Burbank	CA
09353	C and K Components, Inc.	Newton	MA
11432	Diamond Metal Sales	Gardena	CA
11815	Cherry Rivet Div., Townsend Co.	Santa Ana	CA
12020	Ovenaire, Incorporated	Charlottesville	VA
12143	Bendix Corporation	Santa Ana	CA
12405	Hysol Corporation	El Monte	CA
12406	Elpac, Incorporated	Fullerton	CA
12463	Omtronics Mfg., Incorporated	Omaha	NE
12673	Wesco Electrical Co.	Greenfield	MA
12697	Clarostat Mfg. Co., Incorporated	Dover	NH
13103	Thermalloy Company	Dallas	TX
13454	Texas Crystals	River Grove	IL
13571	Electronic Research	Overland Park	KS
13919	Burr-Brown Research Corp.	Tucson	AS
14099	Semtech Corporation	Newbury Park	CA
14193	Cal-R Inc.	Santa Monica	CA
14604	Elmwood Sensors Inc.	Cranston	RI
14655	Cornell-Dubilier Elect. Corp.	Newark	NJ
14674	Corning Glass Works	Corning	NY
14726	Hollingsworth Co.	Phoenixville	PA
14752	Electro Cube, Incorporated	San Gabriel	CA
14907	Cramer Div. of Conrac	Old Saybrook	CT
15112	Electra Scientific Corporation	Fullerton	CA
15636	Elec-trol	Northridge	CA
15801	Fenwall Electronics	Framingham	MA
15818	Amelco Teledyne, Incorporated	Mt. View	CA
15909	Use Code #17870		
15912	Ansley	Los Angeles	CA
16067	California Instruments Company	San Diego	CA
16758	Delco Radio Div., General Motors	Kokomo	IN
16795	Bristol Electronics Inc.	Bedford	MA
16902	Simpson Instruments, Inc.	Escondido	CA
16950	Precision Dynamics Corp.	Burbank	CA
16956	Dennison	Framingham	MS
17745	Angstrohm Precision, Inc.	Van Nuys	CA
17838	Mektron, California General, Inc.	Chula Vista	CA
17856	Siliconix	Santa Clara	CA
17870	Daven Div., Thomas A. Edison	Manchester	NH
18076	Umpco	City of Industry	CA
18121	Wilshire Foam Products, Inc.	Gardena	CA
18178	Vactec Inc.	Maryland Heights	MO
18324	Signatics	Sunnyvale	CA
18612	Vishay Instruments Inc.	Malvern	PA
18677	Scambe Mfg. Co.	Monterey Park	CA
18702	Ducommun Metals and Supply Co.	Los Angeles	CA
18722	R C A	Mountaintop	PA
19080	The Robinson Company	Hawthorne	CA
19781	Potter Company	Sun Valley	CA
20857	South Bay Cable Corp.	Gardena	CA
21270	Behr-Manning	Watervliet	NY
21604	Buckeye Stamping Company	Columbus	OH
22045	Jordan Elect.	Van Nuys	CA
22599	Elastic Stop Nut Corporation	Van Nuys	CA
23039	Deccofelt Products Company	Glendora	CA
23050	Product Components Corp.	Hastings-on-Hudson	NY
23095	Aztec Electronics In.	Anaheim	CA
23783	British Radio Electric Ltd.	Washington	DC
23936	Pamotor, Incorporated	San Francisco	CA
24011	E C C	Burlington	MA
24655	General Radio	Concord	MA
24796	Parelco Inc.	Paramount	CA
24931	Specialty Connector Co., Inc.	Indianapolis	IN
25403	Amperex (Diodes)	Slaterville	RI
25684	Victoreen Instrument Co., Inc.	Oak Lawn	IL
25706	Daburn Electronics and Cable Corp.	New York	NY
*01963	Cherry Electronical Prod. Corp.	Waukegan	IL
26528	Lamcor Incorporated	Anaheim	CA
26533	Use Code #98376		
26806	American Zettler Inc.	Costa Mesa	CA
27014	National Semi-Conductor Corp.	Santa Clara	CA
27191	Cutler-Hammer, Inc.	Milwaukee	WI
27264	Molex	Downers Grove	IL
27556	IMB Electronic Products	Santa Fe Springs	CA
27683	Varo, Incorporated	St. Garland	TX
27832	Hughes Aircraft	Newport Beach	CA
28480	Hewlett-Packard Co.	Palo Alto	CA
*28520	Heyman Mfg. Company (Heyco)	Kenilworth	NJ
30086	I-T-E Circuit Breaker Co.	Philadelphia	PA
30817	Instrument Specialties Co.	Little Falls	NJ
30897	Dorann Co.	Sylmar	CA
30983	Electra/Midland (Mepco/Electra)	San Diego	CA
31743	Elpower	Santa Ana	CA
31951	Triridge Inc.	Pittsburgh	PA
32293	Intersil	Cupertino	CA
34333	Silicon General	Westminister	CA
34649	Intel Corp.	Santa Clara	CA
35929	Constanta	Quebec	CN
42190	Muter Company	Chicago	IL
44655	Ohmite Manufacturing Company	Skokie	IL
45722	Parker-Kalon	Clifton	NJ
46384	Penn. Eng. and Mfg. Corp.	Doylestown	PA
49956	Raytheon Co.	Lexington	MA
50522	Monsanto, Electronic Special Products	Cupertino	CA
50558	Electronic Concepts Inc.	Eatontown	NJ
51705	ICO/Rally	Palo Alto	CA
52072	Circuit Assembly Corp.	Costa Mesa	CA
53209	W. H. Brady Co.	Milwaukee	WI
56289	Sprague Electric Company	North Adams	MA
57701	Stimson	Bayport	NY
58474	Superior Electric Company	Bristol	CT
59730	Thomas and Betts Company	Elizabeth	NJ
60741	Triplett Electrical Instrument Co.	Bluffton	OH
63743	Ward Leonard Electric Co.	Mt. Vernon	NY
70318	Allmetal Screw Prod. Co.	Garden City	NY
70903	Belden Manufacturing Co.	Chicago	IL
71002	Birnbach Radio Company, Inc.	New York	NY
71218	Bud Radio	Willoughby	OH
71279	Cambridge Thermionic Corp.	Cambridge	MA
71400	Bussman Mfg. Div. McGraw-Edison Co.	St. Louis	MO
71450	CTS Corporation	Elkhart	IN
71468	ITT Cannon Electric Inc.	Los Angeles	CA
71590	Centralab Div. Globe-Union, Inc.	Milwaukee	WI
71707	Coto-Coil	Providence	RI
71744	Chicago Miniature Lampworks	Chicago	IL
71785	Cinch Manufacturing Company	Chicago	IL
72136	Elmenco (Electro Motive)	Willimantic	CT
72259	Nytronics, Incorporated	Pelham Manor	NY
72619	Dialight Corporation	Brooklyn	NY
72699	General Instruments	Newark	NJ
72982	Erie Technological Products, Inc.	Erie	PA
73138	Beckman Instruments, Inc.	Fullerton	CA
73445	Amperex (Capacitors)	Long Island	NY
73559	Carling Electric, Inc.	West Hartford	CT
73734	Federal Screw Products, Inc.	Chicago	IL
73899	J F D Electronics Company	Brooklyn	NY
73949	Guardian Electric Mfg. Co.	Chicago	IL
73957	Groov-Pin Corporation	Ridgefield	NJ
74193	Heinemann Electric Company	Trenton	NJ
74276	Signalite, Incorporated	Neptune	NJ
74542	Hoyt Electrical Instrument Works	Penacook	NH
74545	Harvey Hubbel, Inc.	Bridgeport	CT
74970	E. F. Johnson Company	Waseca	MN
75382	Kulka Electric Corporation	Mt. Vernon	NY
75915	Littlefuse, Incorporated	Des Plaines	IL
75987	Use Code #95987		
76055	Mallory Controls	Frankfort	IN
76348	Miller Products Company	New York	NY
76385	Minor Rubber Co.	Bloomfield	NJ
76493	J. W. Miller Company	Los Angeles	CA
76854	Oak Manufacturing Company	Crystal Lake	IL
77342	Potter and Brumfield Div., Amer. Machine and Foundry Company	E. Princeton	IN
77638	General Instruments	Brooklyn	NY
77969	Rubber Craft Corp. of California	Torrance	CA
78189	Shakeproof Div., Illoms Tool Works	Chicago	IL
78299	Struthers-Dunn, Incorporated	Pitman	NJ
78488	Stackpole Carbon Company	St. Marys	PA
78526	Stanwyck Winding Company, Inc.	Newburgh	NY
78553	Tinnerman Products, Inc.	Cleveland	OH
78947	Ucinite Company	Newtonville	MA
79130	Johns-Manville Products Corp.	Chicago	IL
79727	Continental-Wirt Electronics Corp.	Warminister	PA
79963	Zierick Mfg. Corporation	New Rochelle	NY
80031	Mepco/Electra	Morristown	NJ
80112	G. C. Electronics Company	Los Angeles	CA
80223	United Transformer Co.	New York	NY
80294	Bourns, Incorporated	Riverside	CA
80368	Sylvania Electric Products, Inc.	New York	NY
80583	Hammarlund Mfg. Co.	Red Bank	NJ
81073	Grayhill, Incorporated	La Grange	IL
81095	Triad Transformer Corp.	Venice	CA
81312	Winchester Electronics	Oakville	CT
81349	Military Spec., Standardization Division Directorate of Logistic Services DSA		
82104	Standard Grigsby	Aurora	IL
82389	Switchcraft, Incorporated	Chicago	IL
82877	Rotron Manufacturing Co., Inc.	Woodstock	NY
82893	Vector Electronics Inc.	Sylmar	CA
83058	Car Fastener Company	Cambridge	MA
83125	Nytronics Inc. Cap. Division	Darlington	SC
83324	Rosan, Incorporated	Newport Beach	CA
83330	Herman H. Smith, Inc.	Brooklyn	NY
83594	Burroughs Corporation	Plainfield	NJ
83701	Electronic Devices, Incorporated	Yonkers	NY
83781	Natl. Electronics	Geneva	IL
83827	Resistors Inc.	Chicago	IL
84171	Arco Electronics, Inc.	Great Neck	NY
86684	R C A	Harrison	NJ
86928	Seastrom Mfg. Co.	Glendale	CA
87034	Marco-Oak Industries	Anaheim	CA
88026	Use Code #27191		
88245	Useco Div., Litton Industries	Van Nuys	CA
89536	Fluke	Seattle	WA
90030	USM Corp.	Beverly	MA
90201	Mallory Capacitor Company	Indianapolis	IN
91459	Alcon Metal Prod. Inc.	Chicago	IL
91506	Augat	Attlebord	MA
91637	Dale Electronics, Inc.	Columbus	NE
91662	Elco Corporation	Willow Grove	PA
91812	Janco Corporation	Burbank	CA
91833	Keystone Electronics Corp.	New York	NY
91929	Micro Switch Div., Honeywell, Inc.	Freeport	IL
92194	Alpha Wire Corporation	Elizabeth	NJ
92219	Waldom Electronics, Inc.	Chicago	IL
93332	Sylvania Electric Products, Inc.	Woburn	MA
94222	Southco, Incorporated	Lester	PA
95146	Alco Electronics Products	Lawrence	MA
95303	R C A	Cincinnati	OH
95348	Gordos Corp.	Bloomfield	NJ
95416	Use Code #95146		
95987	Weckesser Company, Inc.	Chicago	IL
96682	Genisco, Incorporated	Compton	CA
96733	San Fernando Electric Mfg. Co.	San Fernando	CA
97525	Electronic Engineering Co.	Santa Ana	CA
97918	Linemaster Switch Corp.	Woodstock	CT
97954	U.S. Components, Incorporated	Bronx	NY
98159	Rubber Teck, Incorporated	Gardena	CA
98278	Microdot, Incorporated (Lerco)	S. Pasadena	CA
98291	Sealectro Corp	Mamaroneck	NY
98376	Zero Mfg. Co. (West)	Burbank	CA
98978	IERC	Burbank	CA
99028	Globe	Gardena	CA
99378	Atlee Corp.	Woburn	MA
99392	STM Corporation	Oakland	CA
99515	Marshall Industries	Monrovia	CA
99517	Vacco Industries	El Monte	CA
99742	Permacel Div., Johnson and Johnson	New Brunswick	NJ
99743	I M C	Maywood	CA
99800	Delevan Electronics Corporation	Aurora	NY
*29990	American Technical Ceramics	Huntington Station	NY

ONE YEAR WARRANTY

CALIFORNIA INSTRUMENTS, A NORLIN TECHNOLOGY COMPANY warrants each instrument manufactured by them to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. Excepted from this warranty are tubes, fuses, and batteries which carry the warranty of their original manufacturer where applicable. CALIFORNIA INSTRUMENTS will service, replace, or adjust any defective part or parts, free of charge, when the instrument is returned to the Company freight prepaid, and when examination reveals that the fault has not occurred because of misuse or abnormal conditions of operation. Equipment repaired beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. CALIFORNIA INSTRUMENTS will submit an estimate for such charges before commencing repair if so requested.

PROCEDURE FOR SERVICE

If a fault develops, notify CALIFORNIA INSTRUMENTS or its local representative, giving full details of the difficulty, and including the model number and serial number. On receipt of this information, service data or shipping instructions will be furnished. If shipment is indicated, forward the instrument, freight prepaid, to the authorized repair station indicated in the instruction. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

DAMAGE IN TRANSIT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. CALIFORNIA INSTRUMENTS will advise the disposition to be made of the equipment and arrange for repair or replacement. Please include model number and serial number when referring to the instrument.

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